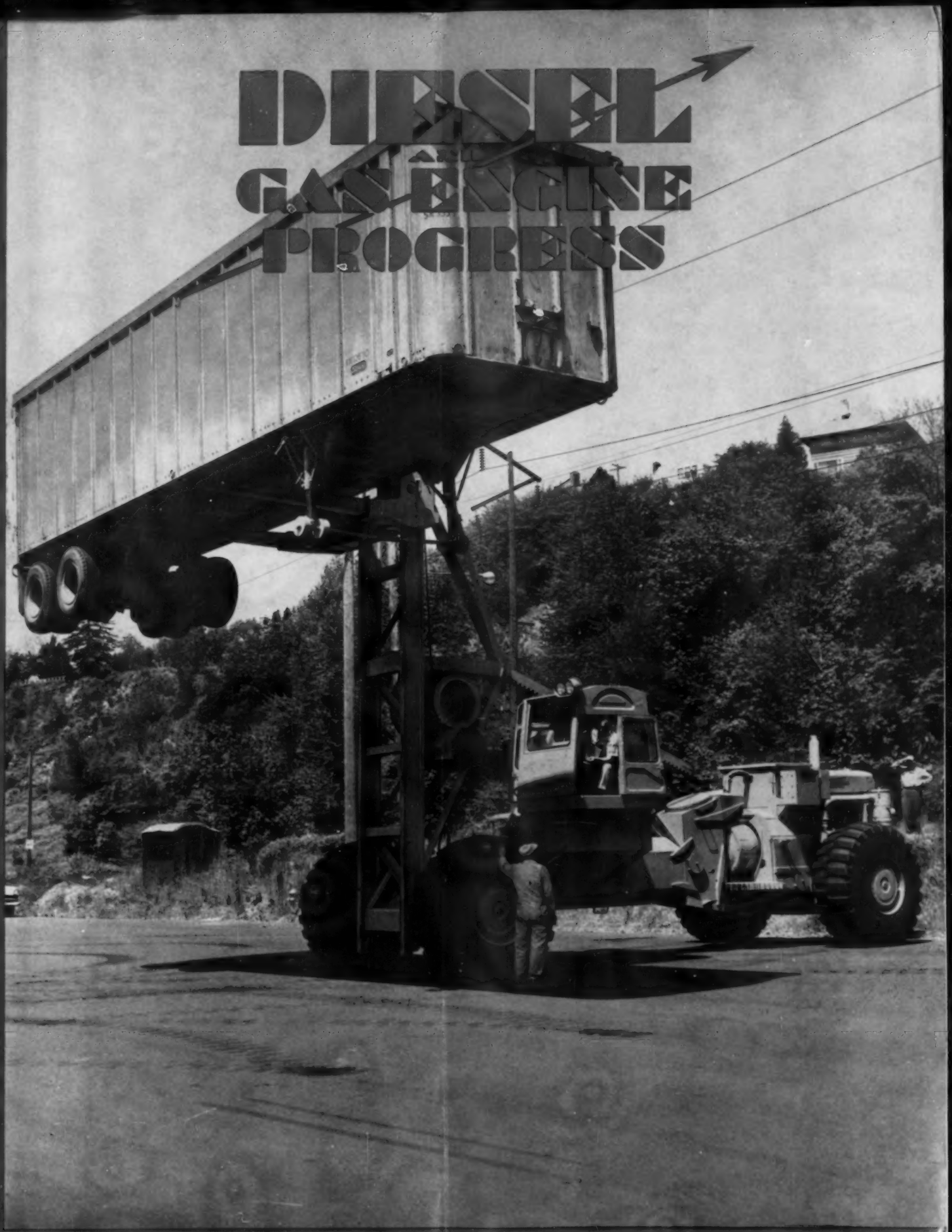
DIESEL GAS ENGINE PROGRESS



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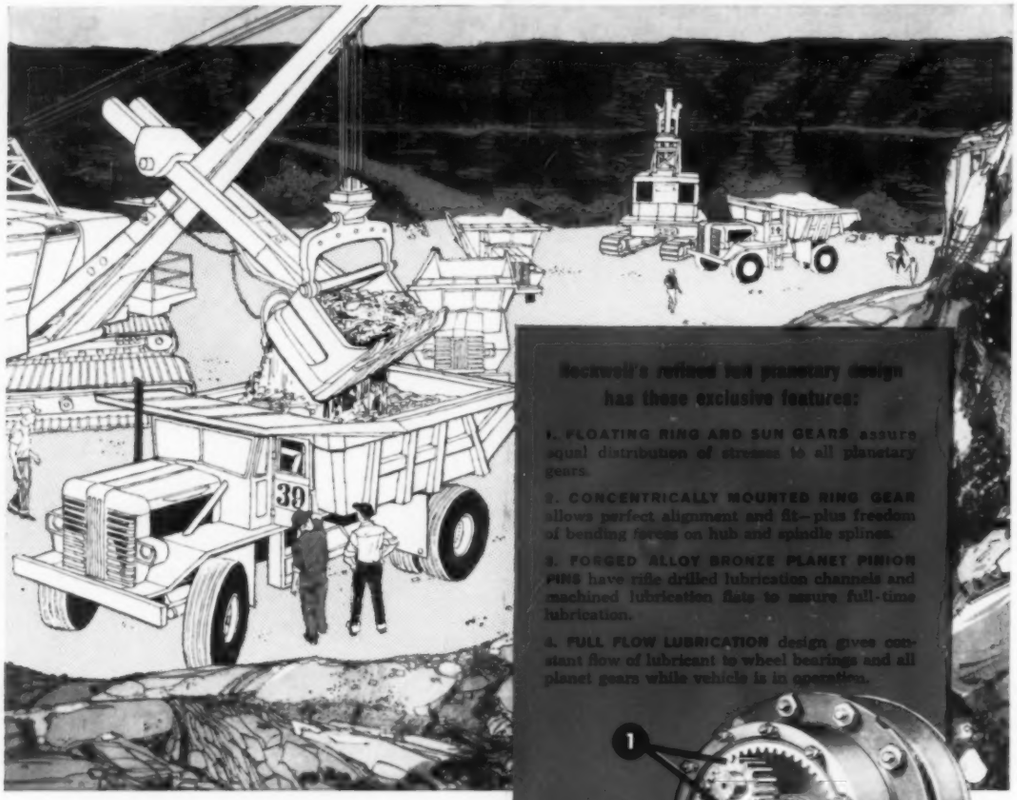
FIVE DOLLARS PER YEAR SEPTEMBER, 1961 FIFTY CENTS PER COPY



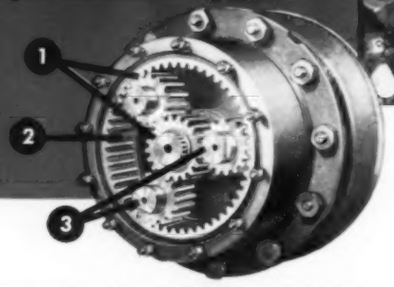
Rockwell's refined full planetary design has these exclusive features:

1. **FLOATING RING AND SUN GEARS** assure equal distribution of stresses to all planetary gears.

2. **CONCENTRICALLY MOUNTED RING GEAR** allows perfect alignment and fit—plus freedom of bending forces on hub and spindle splines.

3. **FORGED ALLOY BRONZE PLANET PINION PINS** have rifle drilled lubrication channels and machined lubrication flats to assure full-time lubrication.

4. **FULL FLOW LUBRICATION** design gives constant flow of lubricant to wheel bearings and all planet gears while vehicle is in operation.



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BEST DRIVE FOR THE HEAVYWEIGHTS!"

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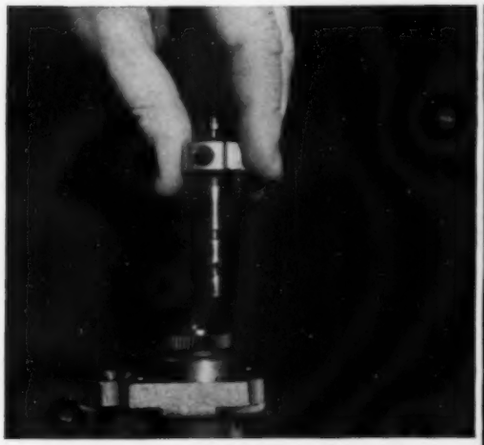

1. Remove the plunger from the fuel injection pump of a Cat Engine.

2. Hold the plunger in your hand for 60 seconds.

3. In that minute, the heat from your hand causes the plunger to expand enough so that it can't fit the barrel.

This shows the close tolerance and refinement built into Caterpillar Engines

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engine power
BY CATERPILLAR

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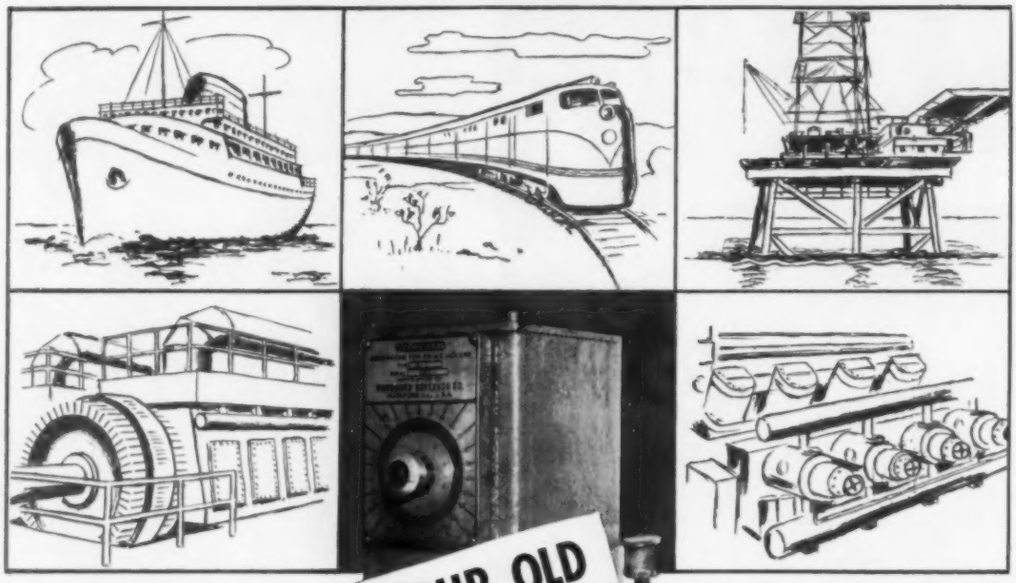

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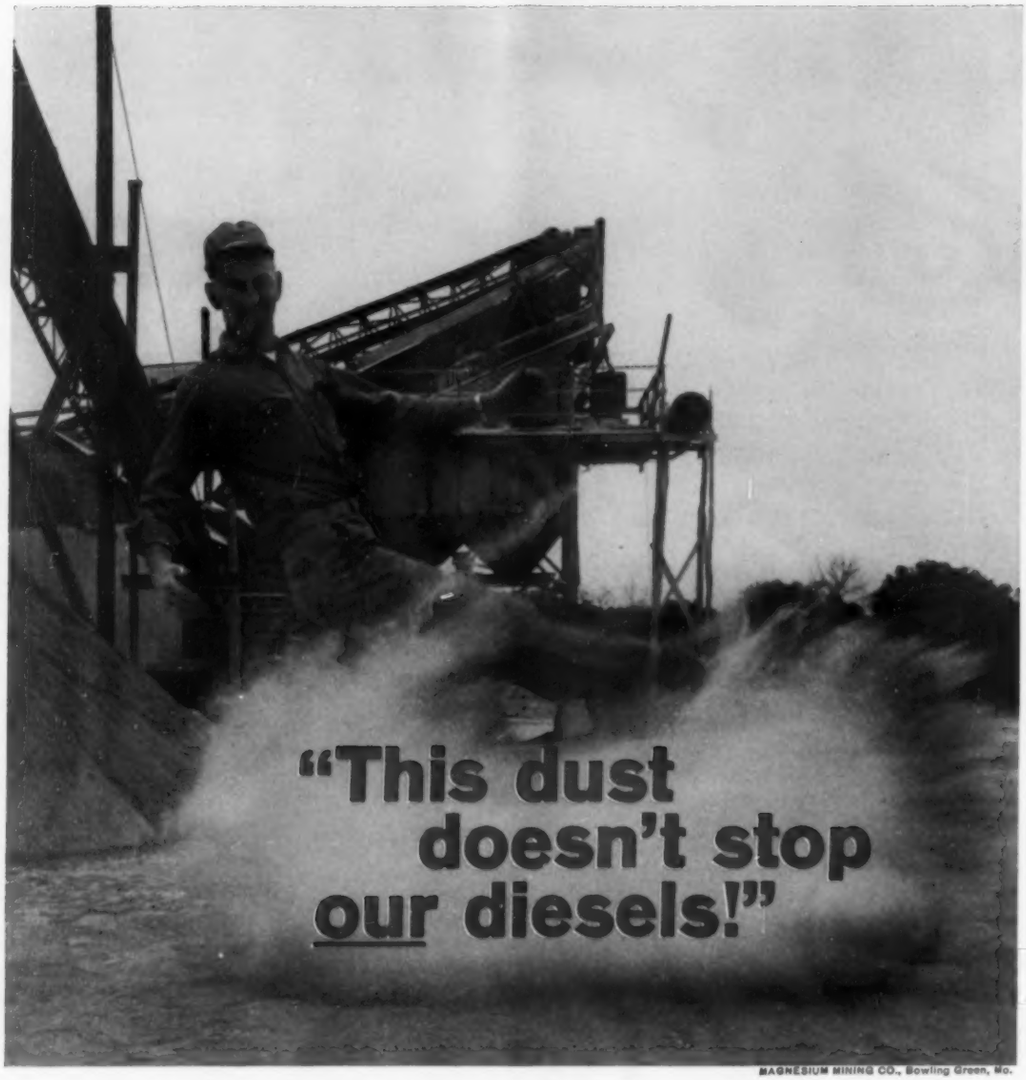
50-ton diesel-electric lift truck built by R. G. LeTourneau, Inc., handles 35 ft. trailer at Portland, Ore. Unit is powered by Cummins 275 hp diesel driving ac, dc generators.



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Fitzgerald attributes the outstanding performance of his equipment to Cities Service DC-300 Oil. DC-300 is another quality product developed through Cities Service research. It prevents rust, sludge and deposits ... helps increase engine life and performance.

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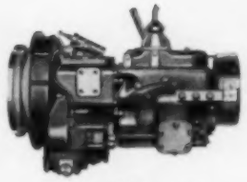
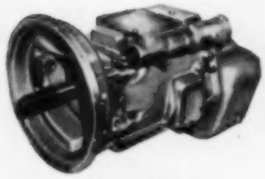


TRANSVERTERS
torque converter-clutch-transmission packages



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The savings are obvious. Proven performance. Lower cost. And faster delivery.

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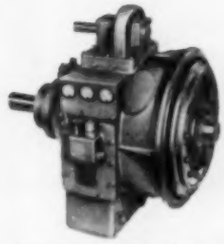

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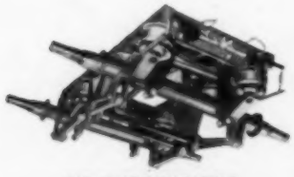
9" to 28" diameters



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transmissions, axles, PTO's

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45,000 to 180,000 lbs

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...15 seconds with Fairbanks-Morse Diesels

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Opposed-piston design minimizes vibration, produces fine balance . . . smooth power and instant response that result in 15 second full-power operation. Available with 4, 5, 6, 8, 10 or 12 cylinders, ranging from 450 to 2500 kw per unit, with automatic or manual controls. **For full details or custom specifications, write today to: S. K. Howard; Director of Marketing; Fairbanks, Morse & Co.; Beloit Division; Beloit, Wisconsin.**

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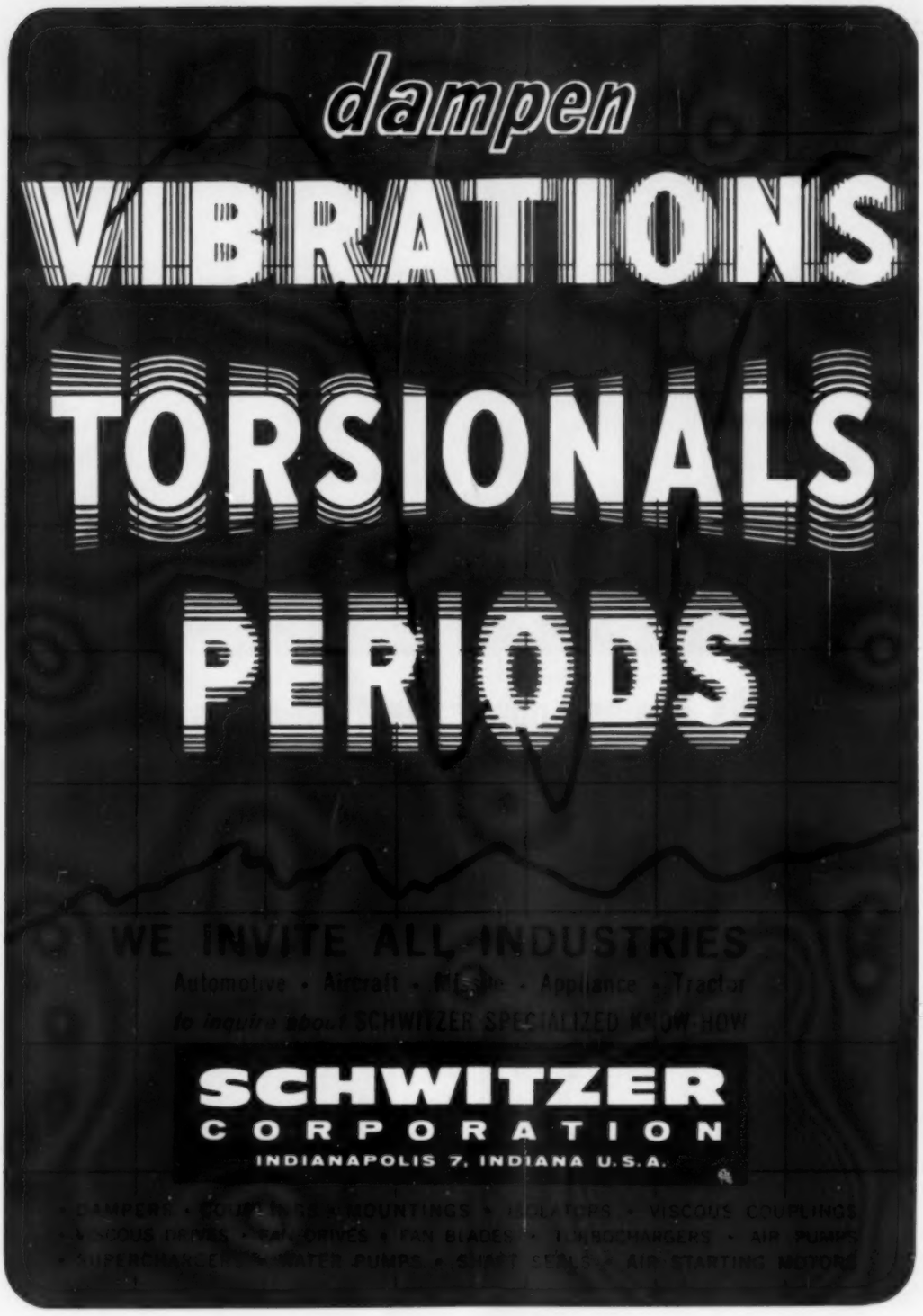
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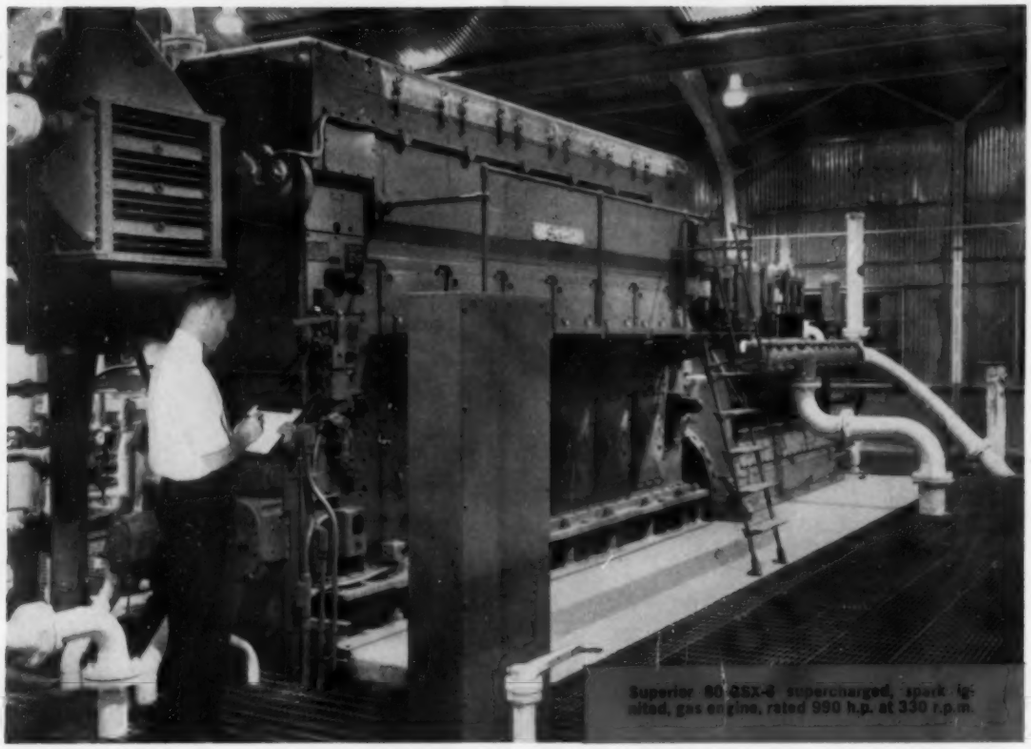

Superior 80-GSX-6 supercharged, spark ignited, gas engine, rated 990 h.p. at 330 r.p.m.

SUPERIOR engines power West Texas waterflood

100% SECONDARY RECOVERY EXPECTED

Six Superior 80-GSX-6 supercharged, spark ignited gas engines and twelve 6G-510 gas engines drive the pumps for one of the largest oil company's two large waterflood plants in West Texas. These busy plants inject 120,000 barrels of water per day at 2,150 p.s.i. into the two fields covering 20,000 acres and 520 oil wells.

During the life of this waterflood program, it is expected the secondary oil recovery will equal the primary production which exceeded 100,000,000 barrels.

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Superior 6G-510 naturally aspirated gas engine, rated 288 h.p. at 825 r.p.m.

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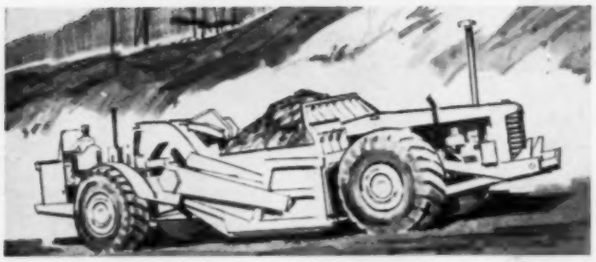
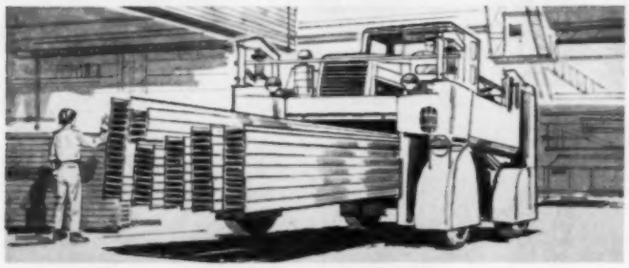


IN 14-YARD SCRAPERS

"Twin Power"—made possible by twin Allison CT-3340 TORQMATIC DRIVES in this Euclid TS-14 scraper -- makes every operation smoother. Production is as much as 100% higher, cost per yard 50% less, than for scrapers pulled by tractors.



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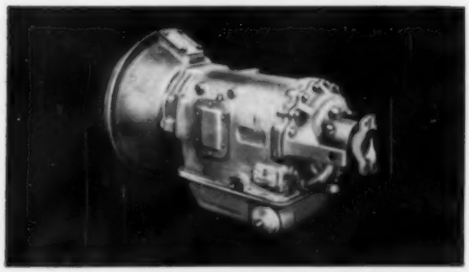

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Small off-highway trucks, fire trucks, airport tow tractors, graders—a whole long list of equipment becomes better equipment with an Allison CT-3340 TORQMATIC DRIVE.

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Want more information? Send for the fact-packed CT-3340 brochure today.

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If you've had trouble with your top piston rings (excessive groove wear, groove damage, ring breakage, etc.) you won't need to be convinced that the top ring carries from 50 to 80% of the sealing load. Installing top rings of special, expensive materials is often not the answer. They may be shock-resistant but generally lack adequate wearing qualities. One likely solution is installation of a Cooktite sealing ring in the THIRD groove to relieve the load carried by the first ring. In an engine with a compression pressure of 500 psi and a firing pressure of 1000 psi, a Cooktite ring in the third groove will reduce the pressure differential on the top ring from a trouble-causing 750 psi to an easily-handled 500 psi. Ask a C. Lee Cook representative to explain in detail.

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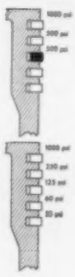

WITH COOKTITE SEALING RING IN THIRD GROOVE

500 psi

WITHOUT COOKTITE RING IN THIRD GROOVE

750 psi

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SEND FOR FREE 8-PAGE BOOKLET

Write for your free copy of this technical article. Gives valuable data on improving your engine's performance and keeping it high for longer periods by better cylinder sealing. Offers practical advice on (1) how to tell whether rings should be reused or replaced, (2) choosing a ring setup, (3) relieving top ring load, and other problems. In short, it's a brief, handy guide to better piston ring performance. For your copy, write C. Lee Cook Division, Dover Corp., 940 South 8th Street, Louisville 3, Kentucky.

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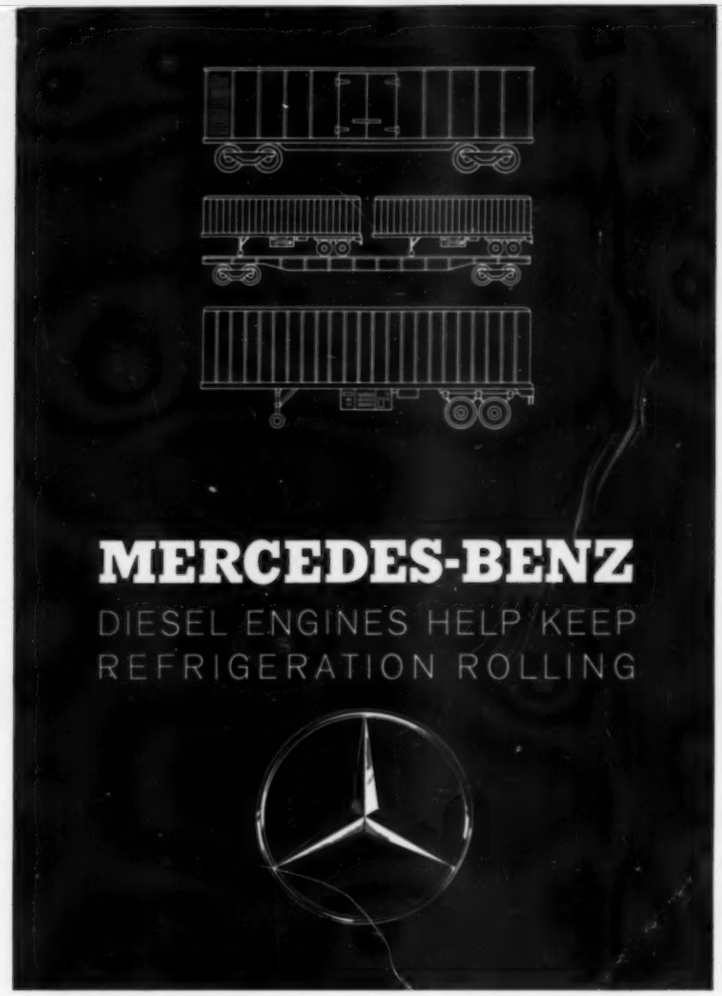

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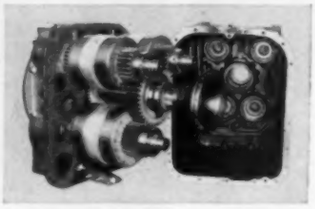


TEST REPORT on Twin Disc's New Power-Shift Transmission

Assignment: Hauling copper ore at Arizona mine

At the open pit copper mine of Inspiration Consolidated Company, Inspiration, Arizona, 22 dump trucks work around the clock, seven days a week, to haul out 105,000 tons of ore and 75,000 tons of waste rock. As a test of vehicle endurance, this is about as grueling an operation as you could find anywhere. It was here that Twin Disc's new Series TA-51-2000 Power-Shift Transmission was asked to prove itself.

For testing purposes the transmission was installed in Truck No. 62, a 40-ton Dart 37SL Dump Truck powered with a Cummins NVH-1200 Diesel. This engine produces about 420 net hp (2100 rpm) at the flywheel.

Along with the other 21 trucks in the Inspiration fleet, Truck No. 62 was put to work on the three-mile haul road between pit and crusher.

Result: Six more transmissions ordered

In six months on the job the Twin Disc transmission proved its worth. Regarding its performance, T. M. Anderson, Open Pit Foreman for Inspiration, had this to say:

"On the basis of cycle times, fuel efficiency and shifting ease, No. 62 has been beating them all since we put in that new power-shift transmission. The truck pulls away from the loading shovel in third converter drive and is already in fifth lock-up drive when it hits the grade."

As a result of the test model's outstanding performance, Inspiration has already ordered six more Twin Disc Series TA-51-2000 Transmissions.

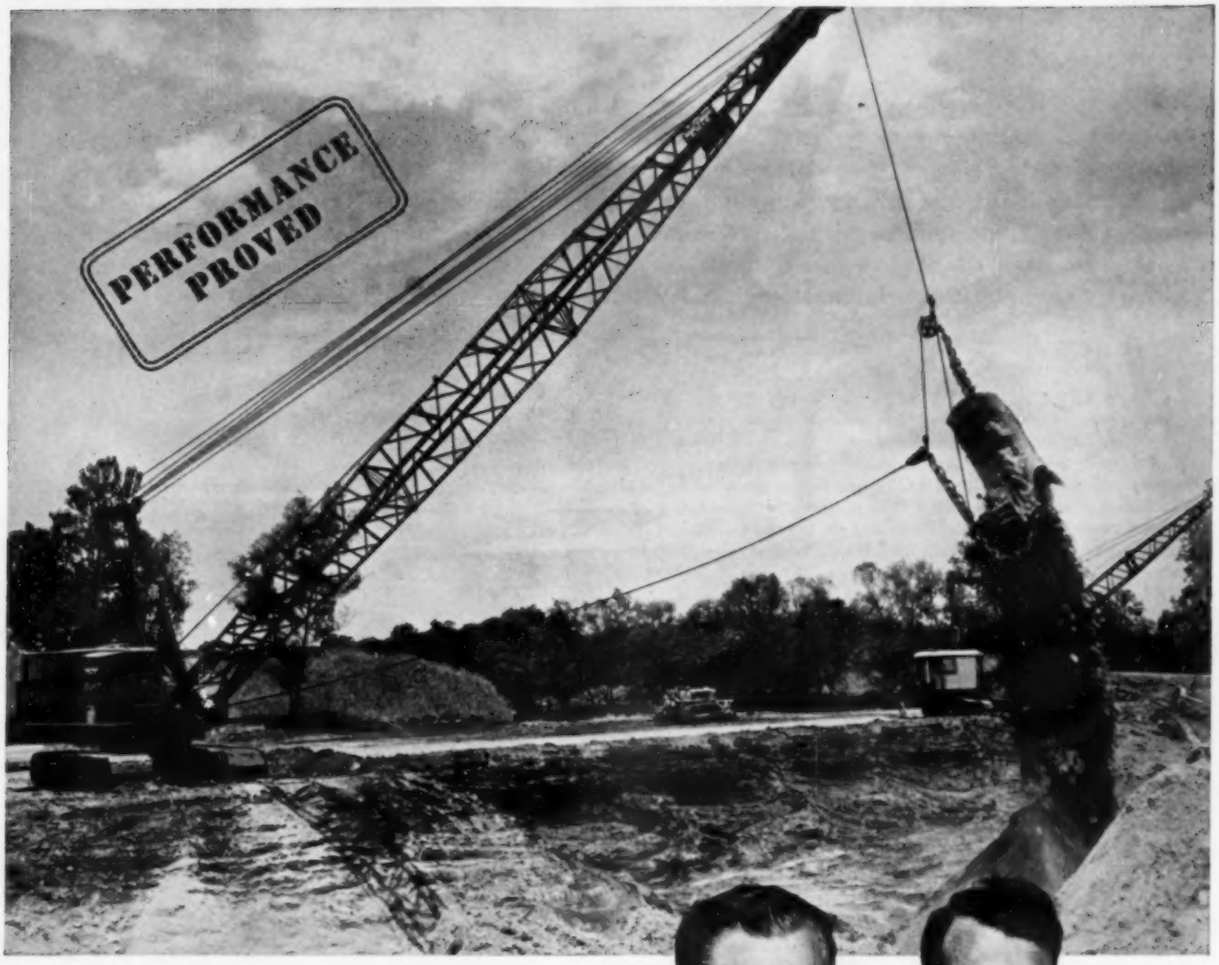
For perfect matching of power to load, specify Twin Disc Power-Shift Transmissions in your vehicles.

Series TA-51-2000, designed for vehicles

- **Three models with ratio spreads of 5.45, 5.93 and 6.80.**
- **Capacities: 420 hp; 1050 lb/ft torque.**
- **Straight-through countershaft design with constant-mesh gearing.**
- **Five forward speeds; one reverse.**
- **Full power-shift in all ranges through oil-actuated clutches.**
- **Engineered as package unit with Twin Disc Single-Stage Torque Converter.**
- **Converter has lock-up clutch on front end to provide direct drive performance when desired.**
- **Hydraulic retarder saves wear on brakes . . . permits safe, controlled descents at higher speeds.**

ENGINE TO AXLE WITH... TWIN DISC

TWIN DISC CLUTCH COMPANY, Racine, Wis. (Hydraulic Division) Rockford, Ill.



This 21000-powered Bucyrus-Erie dragline is swinging a 3-yd bucket on a stripping operation south of Seagoville, Texas.

H. GLENN BUTLER

CLARK FINDLEY

"20% more production on 40% less fuel with our Allis-Chalmers 21000 diesel"

... says Butler-Findley Co.

Repowering a Bucyrus-Erie 54-B dragline with an Allis-Chalmers 21000 diesel boosted stripping operations 20 percent for Butler-Findley Co., Dallas, according to Clark Findley, superintendent and production manager. "This engine has given a good old machine new life and stamina," said Mr. Findley.

H. Glenn Butler adds, "Not only that, we are realizing fuel savings of over 40 percent! The 21000 uses less than 5 gal. per hour compared with over 8 gal. for engines in our other machines of the same capacity. We get more work done with much less operation expense, which means dollars to us."

If you want to boost production and save money doing it, talk to your dealer about powering with a modern Allis-Chalmers diesel. Allis-Chalmers, Milwaukee 1, Wisconsin. BC-33

ALLIS-CHALMERS

POWER **FOR A GROWING WORLD**

Name your engine

Chances are Koppers Piston Rings were installed by the original equipment manufacturer. More leading manufacturers select Koppers Piston Rings for their predictable performance and dependability. Koppers wide range of types and sizes . . . variety of materials . . . control of materials . . . close tolerance manufacture . . . rigid standards of inspection . . . *all* contribute to Koppers leadership in the field.

If you have a problem in ring application, avoid further needless expense and delay. Let us know the type of service (diesel, natural gas engine, dual fuel, compressors, etc.), along with the make and model of the equipment. Our engineers will send you the recommended set-up promptly. Write to: KOPPERS COMPANY, INC., Piston Ring and Seal Department, 6206 Scott Street, Baltimore 3, Maryland.

Koppers Porous Chromium-Plated Compression Rings are used extensively in many types of engines and compressors. Intensive tests have demonstrated that chromium-plated rings in the first or first and second grooves reduce cylinder wear one-quarter to one-third of that experienced with unplated rings. Where operating conditions or dimensional tolerances require a ring that will adapt itself readily to the cylinder, porous chrome-plated compression rings are the most popular type. For special conditions, Koppers also makes available dense, threaded or grooved face chromium-plated rings.

The **Koppers Tapered Ring** has a taper on its outside face of either 1° or 2°, depending on the size of the ring. It is used in gasoline, aircraft, gas and diesel engines, and in compressors because it seats-in more rapidly than other standard compression rings. This advantage makes it especially applicable to hardened or chromium-plated cylinders. In out-of-round or distorted cylinders, its ability to seat-in quickly helps prevent blow-by. It may be used in as many compression ring grooves on a piston as necessary; but, ordinarily, when a quick-seating ring is required for the top groove, a Grooved Back Ring or other special ring is used.

The **Koppers Seal Ring** has one band of bearing bronze rolled into a groove on its face. This band projects approximately .004" beyond the face of the cast iron ring. The ring seats quickly because high unit pressure is exerted on the narrow bronze band, preventing blow-by in new or worn cylinders. As the bronze wears, it burnishes the cylinder wall to a mirror-like surface and allows the cast iron body of the ring to reach a seat very gradually. Throughout the life of the ring, the bi-metallic surface serves more effectively to eliminate scuffing, improve lubrication, and reduce wear on cylinder, rings and piston. This ring may be designed to employ two bronze bands if specified.

The **Koppers Grooved Oilcutter Ring** has a continuous channel around its outside face and a series of slots extending through the ring from the base of the channel; and the upper edges of the bearing surfaces are beveled to ride over the oil film on the upstroke. The lower sides of its scraping edges are undercut to form in each a small oil-collecting groove. The oil caught by the upper scraping edge drains through the slots in the ring. The oil caught by the lower scraping edge drains down the cylinder and through holes drilled through the piston from a drainage groove beneath the oil ring groove. The unit pressure of the ring keeps more nearly uniform; consequently, the efficiency of the ring is more constant.

The outer element of the **Koppers Conformable Grooved Oilcutter Ring** is made of cast iron sufficiently thin in cross section to permit maximum flexibility. The inner element is a coiled steel expander spring, the ends of which are butted together. Closed to cylinder size, the spring exerts uniform radial pressure against the ring, forcing it to conform to the cylinder wall although that surface may be neither round nor true. The spring has a low spring rate in order to prevent any appreciable change in pressure as the ring wears. The Conformable Oil Ring maintains a high unit pressure, uniformly distributed, throughout the life of the ring, providing better oil control. For certain four cycle engines, Koppers provides a notched Conformable Grooved Oilcutter Ring to provide more positive oil drainage.

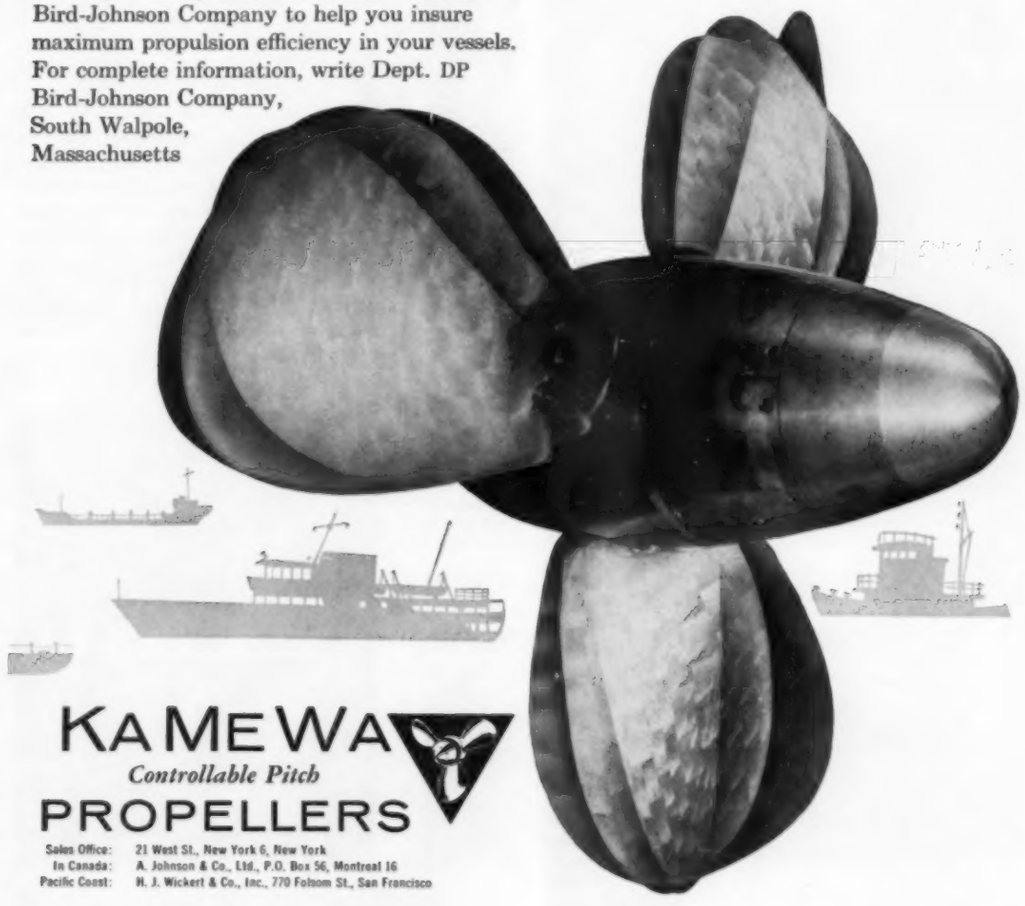
AMERICAN HAMMERED® INDUSTRIAL PISTON RINGS

Engineered* Products Sold with *Service

KaMeWa
LEADS
THE FIELD

THE LARGEST 19 ft. diameter
THE MOST POWERFUL 20,000 H P
THE FASTEST 2,000 R P M
THE MOST UNITS Over 500 now in service
THE WIDEST RANGE from 200 to 20,000 H P
THE MOST EXPERIENCE Pioneers in C P development since 1937

The advantages of KaMeWa controllable pitch propellers have been proved out in more than 500 world-wide installations. This unmatched breadth and depth of experience is available through Bird-Johnson Company to help you insure maximum propulsion efficiency in your vessels. For complete information, write Dept. DP
Bird-Johnson Company,
South Walpole,
Massachusetts

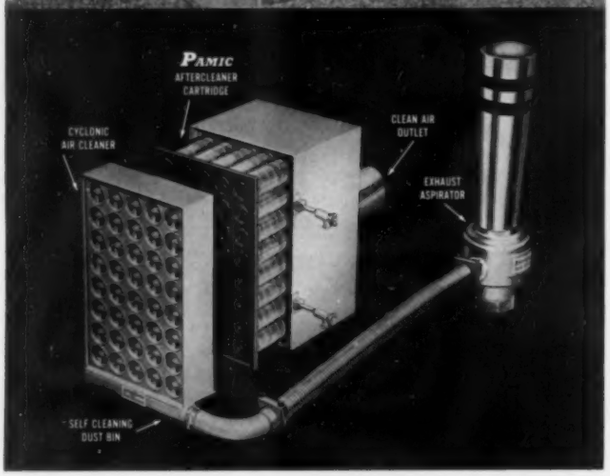


KA ME WA
Controllable Pitch
PROPELLERS

Sales Office: 21 West St., New York 6, New York
In Canada: A. Johnson & Co., Ltd., P.O. Box 56, Montreal 16
Pacific Coast: H. J. Wickert & Co., Inc., 770 Folsom St., San Francisco

The dirtier
it gets,
the better
the **FARR**
ROTOPAMIC
AIR
CLEANER
works

It's a fact. The more the dust flies the more you can rely on Farr RotoPamics to protect your engines. For example, Kenneth H. Golden Company has two Allis-Chalmers HD-20 crawlers operating 8 to 10 hours a day at their rock crusher plant in San Diego. Work is carried on in an extreme fine dust that penetrates everything. The crawlers are powered by diesel engines which were originally equipped with oil bath filters on the air intake. Both engines had to be overhauled *twice within four months!* Two years ago, Farr RotoPamics replaced the oil bath filters *and an engine overhaul has not been necessary since.*



The 2-stage RotoPamic completely protects engines at all times. No daily or weekly maintenance is necessary. FIRST STAGE is a cyclonic separator that spins over 90% of the dirt into the self-cleaning bin. The exhaust aspirator cleans the bin automatically. SECOND STAGE is a dry-type aftercleaner that is *over 99.6% efficient* under all conditions. Replacing the Pamic aftercleaner cartridge is fast and simple. The integral air seal is always new at each service. Change-out is from dirty side of the system; engines do not become contaminated during service.

Your RotoPamic distributor will furnish details, or write to:

FARR
COMPANY
Airport Station, Los Angeles 45, Calif.

Get the facts on the ROTOPAMIC firsthand at the Farr Booth 411 and 412, SAE Heavy-Duty Vehicle Display, Milwaukee, September 11-14

This is Where the Power is Built into

NORDBERG DIESEL ENGINES

Thirty years of research and development experience in the heavy machinery field were focused on the design and manufacture of internal combustion engines when, in 1915, Nordberg became the first American manufacturer of large, heavy duty diesels.

From this unique and specialized engine building experience, there have evolved many exclusive engineering achievements. Today, Nordberg builds the largest line of heavy duty diesel engines in the western hemisphere . . . in sizes from 10 to over 12,000 horsepower in a single engine.

1886-1961 75th ANNIVERSARY

NORDBERG MANUFACTURING COMPANY
Milwaukee 1, Wisconsin

ATLANTA • CLEVELAND • DALLAS • DULUTH • HOUSTON • KANSAS CITY • MINNEAPOLIS • NEW ORLEANS • NEW YORK • PHOENIX
ST. LOUIS • SAN FRANCISCO • TAMPA • WASHINGTON • WICHITA, KANS. • TORONTO • VANCOUVER • JOHANNESBURG • LONDON • MEXICO, D. F.

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P361-B2

Roller Cam Action of Over-Center Clutches
Reduces Wear, Pressure and Adjustments

Rockford exclusive anti-friction roller cams increase clutch life, lower pressure needed to engage and release, and reduce clutch adjustments. Precision-ground, hardened steel rollers force pressure plate against facing and flywheel for smooth, powerful engagements. Actuation progresses from "release" to "on-center" to the slightly "over-center" locked position. Operated by hand lever, Rockford Over-Center Clutches remain in or out of engagement until changed by the operator. Clutches fit flat or counterbored flywheels. Oil or dry operation. Torque loads from 365 to 3,000 lb. ft. Write today for illustrated brochure.

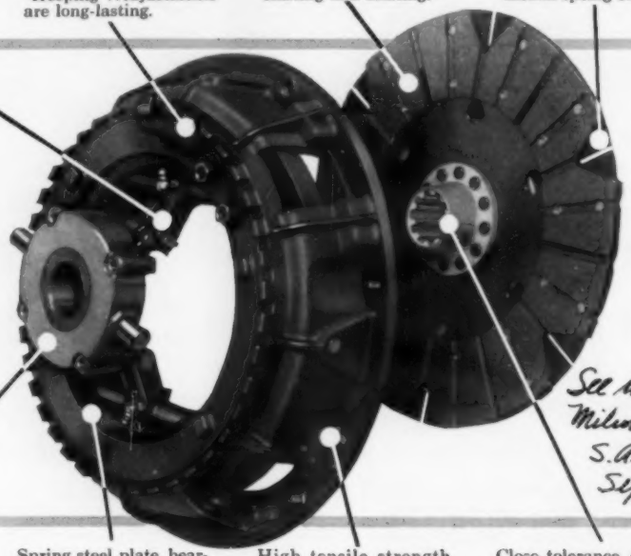
Allis-Chalmers Crawler equipped with Rockford Over-Center Clutch

Patented anti-friction roller cams reduce wear, adjustments, and lever pressure. Slight pressure to rollers forces pressure plate and facing against flywheel, instantaneously locking and engaging clutch.

Positive-lock adjusting ring allows fine adjustments for longer life and smoother starts. Simply release lock and turn to exact engaging position. Positive-lock prevents "creeping". Adjustments are long-lasting.

High-test facings give extra-long clutch life, reduce scoring, and greatly cut costs of downtime, replacement and labor. Strong, lightweight construction permits easy shifting and braking.

Segmental slots prevent "dishing" . . . even under extreme heat conditions. Rotary surface grinding assures perfect, uniform flatness. Core plate is made of special high-carbon spring steel.



See us at the Milwaukee S.A.E. Shows Sept. 11-14

Release bearing assembly consists of bronze or ball bearings. Clutch is actuated from hand lever to yoke contact on trunnions. Pivot pins give direct, smooth actuation between release sleeve and cam arms.

Spring steel plate, bearing against roller cams, yields slightly upon actuation. This assures extremely smooth engagements, relieves cover plate of strains, maintains uniform pressure, and gives longer life.

High tensile strength cover plate assures safe operation. Compact, low-inertia design prevents gear clashing and delayed shifting. Dynamic and static balancing of each clutch eliminates vibration.

Close-tolerance splined hub assures perfect disc alignment. Through-hardened hub gives long life. Bolt circle and pilot dia. accurately locate cover plates. Precision manufacturing eliminates misalignment.

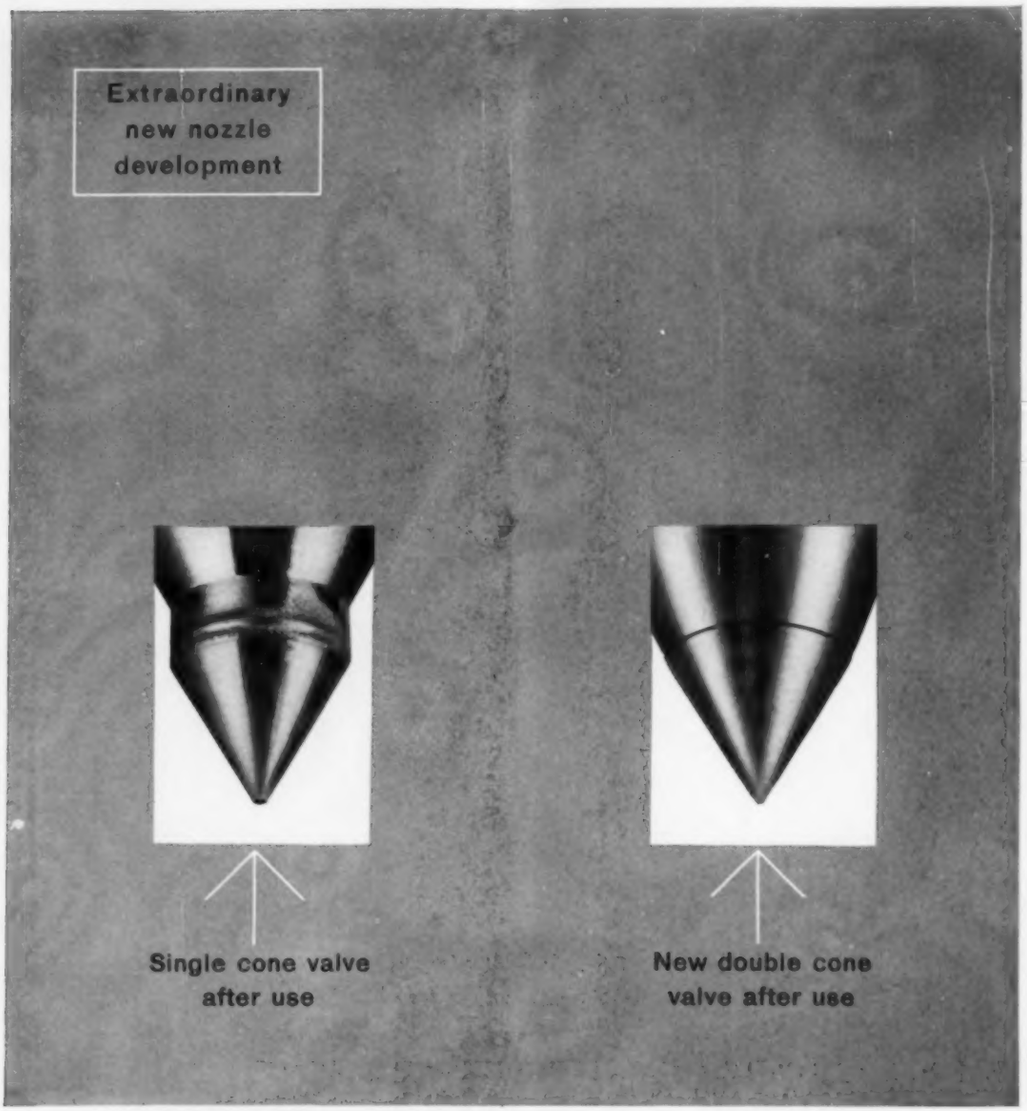
ROCKFORD CLUTCH

1211 WINDSOR ROAD, ROCKFORD, ILLINOIS

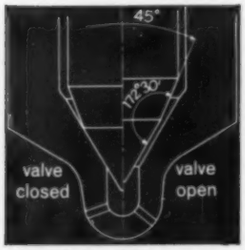
Export Sales Borg-Warner International • 36 So. Wabash, Chicago, Ill.

B-W CLUTCH

DIVISION OF BORG-WARNER



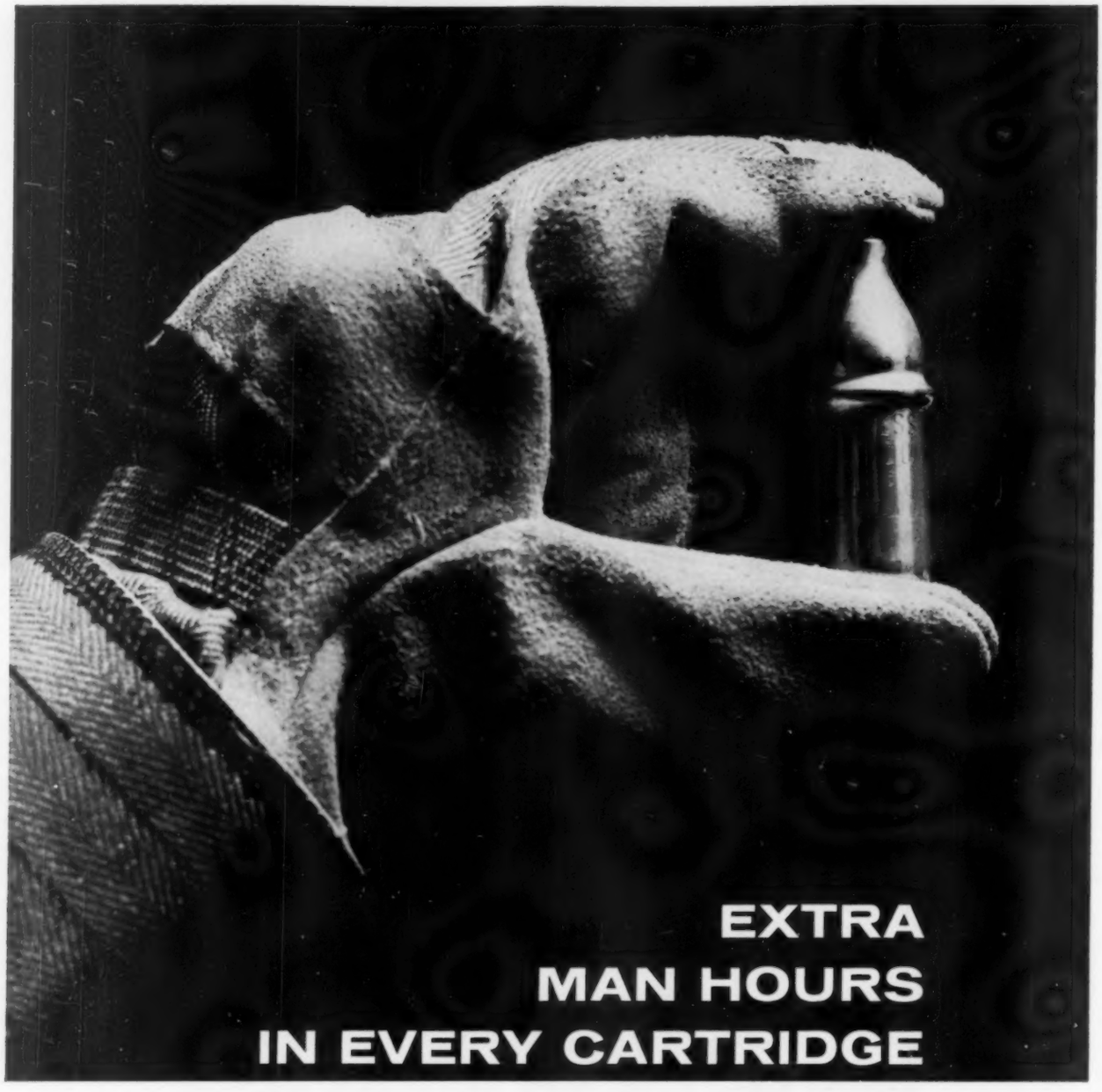
A ROBERT BOSCH exclusive: The double cone nozzle valve seat



Blue print shows new valve seating made possible by the ROBERT BOSCH double cone design.

Here is the first major breakthrough in hole-type nozzle design in many years. What precisely is it? It is an ingenious double cone seat precision engineered to overcome fuel turbulence and resulting cavitation erosion. Closing, hydraulically cushioned to reduce pounding, allows greater valve lift for more flow area. Makes smaller valve seat diameters possible. This patented design which enormously extends nozzle life is exclusive with ROBERT BOSCH, noted for diesel engineering leadership and world-wide service. For complete data write: ROBERT BOSCH CORPORATION, 40-25 Crescent St., Long Island City 1, N.Y. Branch: 225 Seventh St., San Francisco 3, Calif. *Or see us at the Milwaukee SAE Meeting.*

ROBERT BOSCH FUEL INJECTION EQUIPMENT



This steel cartridge contains 5 grams of Chevron Priming Fuel. It's the key unit of a Chevron Pressure Primer System that gives safe, instant starts to engines even in coldest sub-zero weather. Documented case histories of diesel operators show savings of up to 50 man hours a day in stand-by time. Result: lower operating costs all around. You'll also get equipment-saving, fast starts with Chevron Starting Fluid, available in pressurized cans, gelatin capsules or bulk. Find out how you can gain extra man hours with dependable starting by calling our local representative of any company listed below.

STANDARD OIL COMPANY OF CALIFORNIA
San Francisco 20
STANDARD OIL COMPANY OF TEXAS
El Paso
CALIFORNIA OIL COMPANY
Perth Amboy, N.J.—Denver

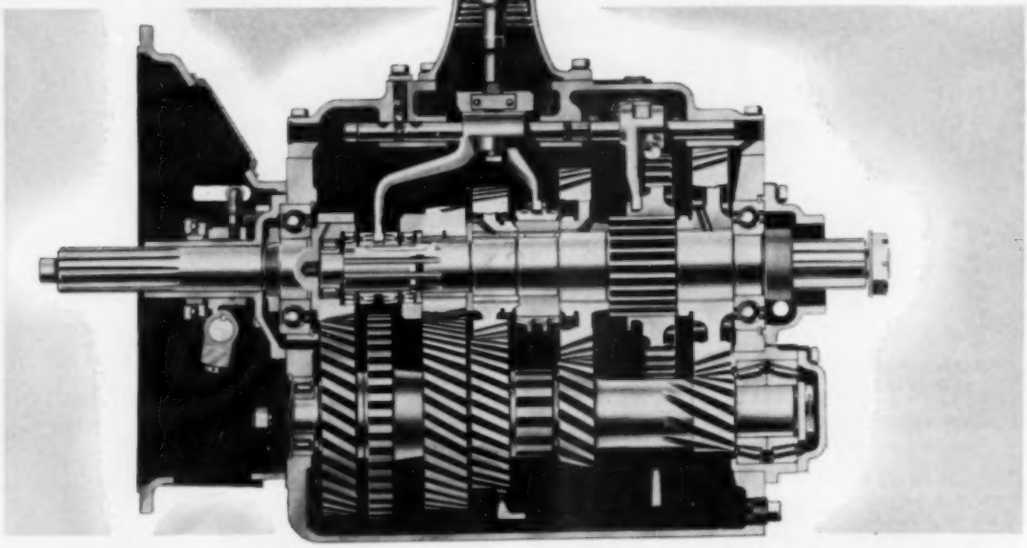
CHEVRON STARTING FLUID

TRADEMARKS "CHEVRON" "PRESSURE PRIMER" AND CHEVRON DESIGN ®

New Light Heavyweight...

FULLER

Models 5-H-74
5-HA-74*



the lightest transmission designed for diesel engines—from 190 hp to 250 hp

In keeping with the trend toward high capacity, light-weight components, Fuller has released its new Model 5-H-74 5-speed Transmission.

The NEW 5-H-74 offers:

- * **Model 5-HA-74 . . . even *lighter* weight — 93 lbs. less — with *aluminum* case and clutch housing**
- **mainshaft of greater diameter**
- **high capacity mainshaft pilot bearing**
- **wide gear faces**
- **all helical gearing—low tooth pressures**
- **short, quick shifts—jaw clutch engaged**
- **short installation—25 11/14" in length**
- **extremely high ratio of capacity to weight**

SPECIFICATIONS
Gear Ratios

5th	1.00
4th	1.17
3rd	1.98
2nd	3.61
1st	6.60
Rev.	6.51

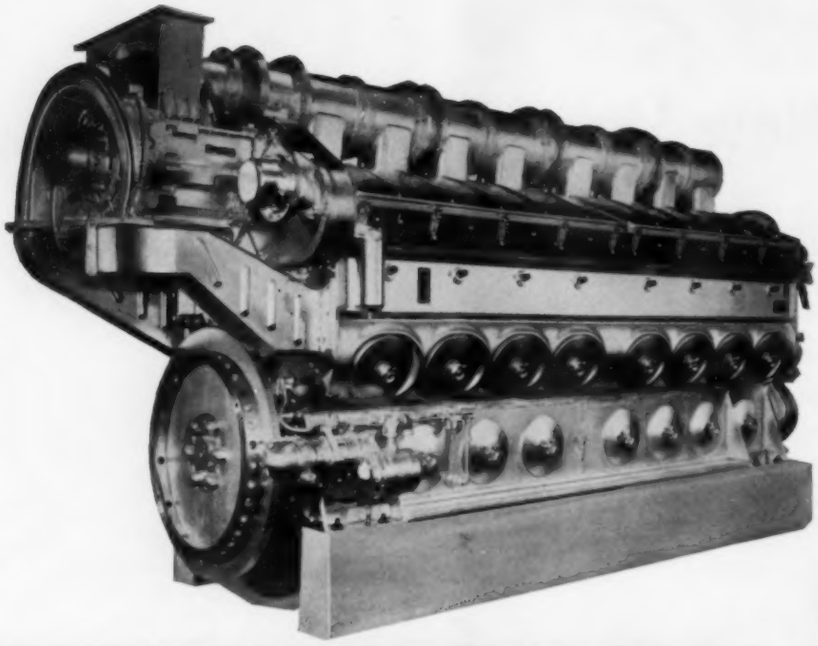
Weight:
Model 5-H-74—461 lbs.
*Model 5-HA-74—368 lbs.

Oil Capacity: 12 quarts.

Length: 25 11/14 inches.

FULLER TRANSMISSION DIVISION
EATON MANUFACTURING COMPANY
KALAMAZOO, MICHIGAN

Sales & Service: West. Dist. Branch, Oakland 6, Cal. • Southwest Dist. Office, Tulsa 3, Okla. • Automotive Prod. Co., Ltd., Automotive House, Great Portland St., London W. 1, Eng., European Rep.



GENERAL MOTORS MODEL 16-567 DMT
TURBOCHARGED DIESEL ENGINE
FOR MARINE SERVICE

The General Motors, 16 cylinder, Model 567 DMT, turbocharged marine diesel engine represents more than 20 years' development of this series engine.

The introduction of the Model 567 DMT for marine service broadens the range of Cleveland Diesel engines from 600 hp to 2800 hp.

Features of the 16-567 DMT Engine in Marine Service are:

1. Improved fuel economy at all speeds and loads.
2. Increased power with little increase in size and weight.
3. Quick response to speed and load changes.
4. Low initial cost.
5. Low maintenance cost.

For complete information concerning General Motors Marine Diesel Engines, contact any of our sales or service representatives.

CLEVELAND DIESEL

CLEVELAND DIESEL ENGINE DIVISION
GENERAL MOTORS CORPORATION
CLEVELAND, OHIO

SALES AND SERVICE OFFICES:

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A GOOD PRODUCT PLUS GOOD SERVICE GIVES GOOD PERFORMANCE

THESE GOOD DIESELS DEPEND ON HMS ROOSA MASTER

In less than 10 years more than 250,000 Roosa Master fuel injection pumps will have served as the heart of these famous diesels. Problems of engine manufacturers have been our greatest asset. Solution of these have led to greater simplicity, greater versatility and increased engine efficiency. Tomorrow's Roosa Master pump will be even more compact, more economical and more versatile. Let our research team help you *before* you design your next diesel. Hartford Machine Screw Company, Division of Standard Screw Company, Hartford 2, Connecticut.

Member

make your good diesel better with HMS ROOSA MASTER

Power plant stretches diesel service -cuts maintenance costs- with AMERICAN D&G Oil No. 53

By C. F. KLENNER **Carl Klenner is a specialist at helping customers with their lubrication problems. A graduate of the Michigan College of Mining and Technology, he has been serving commercial customers since 1948. He also attended the Company's Sales Engineering School.**

★ ★ ★

At Roseau, Minnesota, the Municipal Power Plant uses Fairbanks Morse Diesel Engines for the generation of the city's electricity. And since 1946, lubricating oils supplied by our Company have played an important part in the excellent maintenance of this plant.

For example, diesel unit number two was overhauled in 1954 after six years' service. At our recommendation, AMERICAN D&G Oil No. 53 was put in the crankcase at that time. After 19,000 hours of oil service, the unit was taken down again. All rings were free, bearings and rings showed minimum wear, and there was negligible carbon on the piston skirts. With AMERICAN D&G Oil, this unit has averaged 4,584 horsepower-hours per gallon of oil.

For additional information about AMERICAN D&G Oil, contact your nearby American Oil Office.

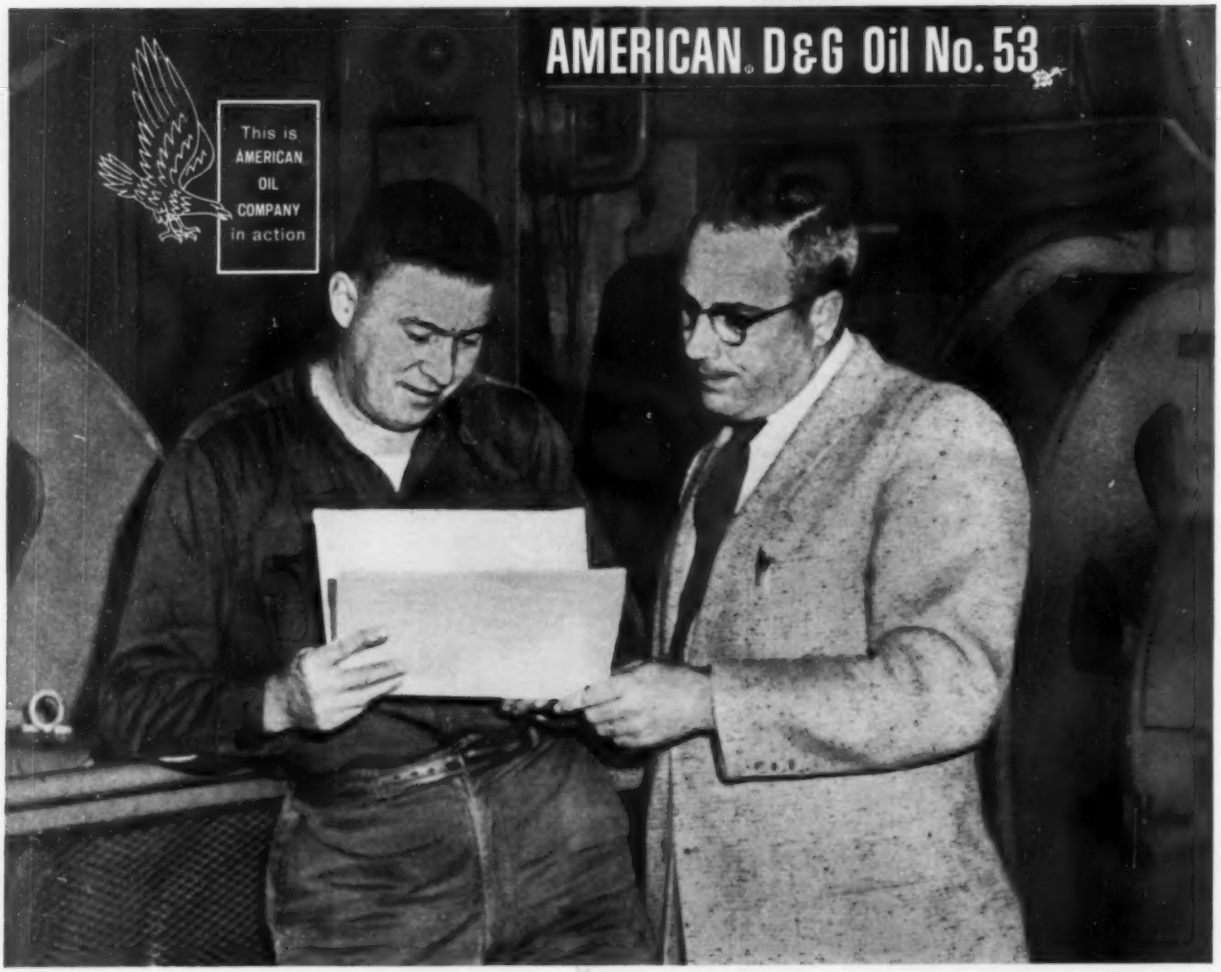
American's C. F. Klenner checks performance reports with power plant superintendent Carl Grand.

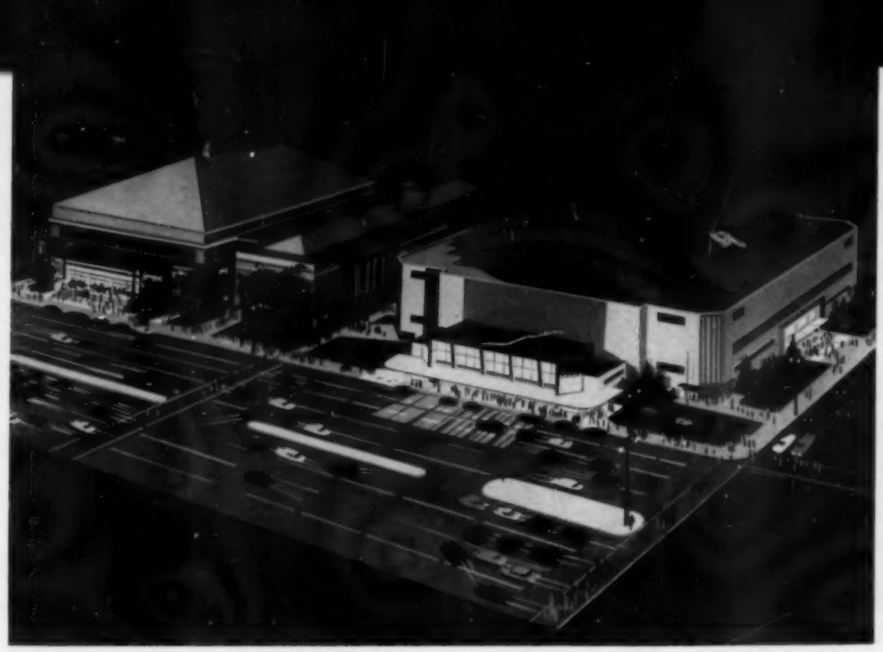
Quick facts about
AMERICAN D&G Oil

- Made from highest quality solvent-refined stock.
- Contains additives which impart superior detergent-dispersant and anti-corrosion properties.
- Anti-foaming.
- Oxidation resistant.
- Recommended for
  —use with economy fuels.
  —extreme load service.
  —low temperature service.

AMERICAN OIL COMPANY
910 S. Michigan Ave., Chicago 80, Ill.

AMERICAN





Here is the Milwaukee Auditorium-Arena, site of the SAE Heavy Duty Vehicle Meeting and Engineering-Display.

SAE HEAVY-DUTY VEHICLE MEETING SET IN MILWAUKEE

Five Major Society Activities Featured Together for First Time; Extensive Forums and Technical Sessions Planned Plus Large Engineering Exhibit

SCHEDULED from September 11 through 14, the forthcoming SAE meeting in Milwaukee takes on added emphasis and importance this year for those men directly interested in the industrial and commercial vehicle industries. The meeting in fact is hinged entirely around "Heavy-Duty Vehicles". For the first time, five major SAE activities (1) Farm, Construction and Industrial Machinery, (2) Powerplant, (3) Transportation and Maintenance, (4) Truck and Bus, and (5) Production, will participate in exceptionally well-planned technical sessions and production forums. Of equal importance is the 130-booth engineering display presenting the latest products for the industry.

General chairman of this year's meeting is Hugh S. Brown, vice president-engineering for Briggs & Stratton Corp. in Milwaukee. According to Brown, "this meeting is a must—top engineering, manufacturing, and management personnel from hundreds of leading companies in this vital and huge segment of heavy industry are expected for this 'Heavy-Duty Vehicle' meeting to discuss and analyze the many trend-setting developments that will be shown and presented at the technical sessions." Projecting attendance, past experience shows over 5,000 attend the National Farm, Construction and Industrial Machinery meeting, over 1,000 attend the National Powerplant meeting, and over 700 at the National Transportation meeting. With these activities all combined under one roof, plus the engineering display, upwards of 7,000 are expected. This without doubt will be the largest SAE meeting in Milwaukee thus far.

Here is a look at some of the prominent features of the meeting:

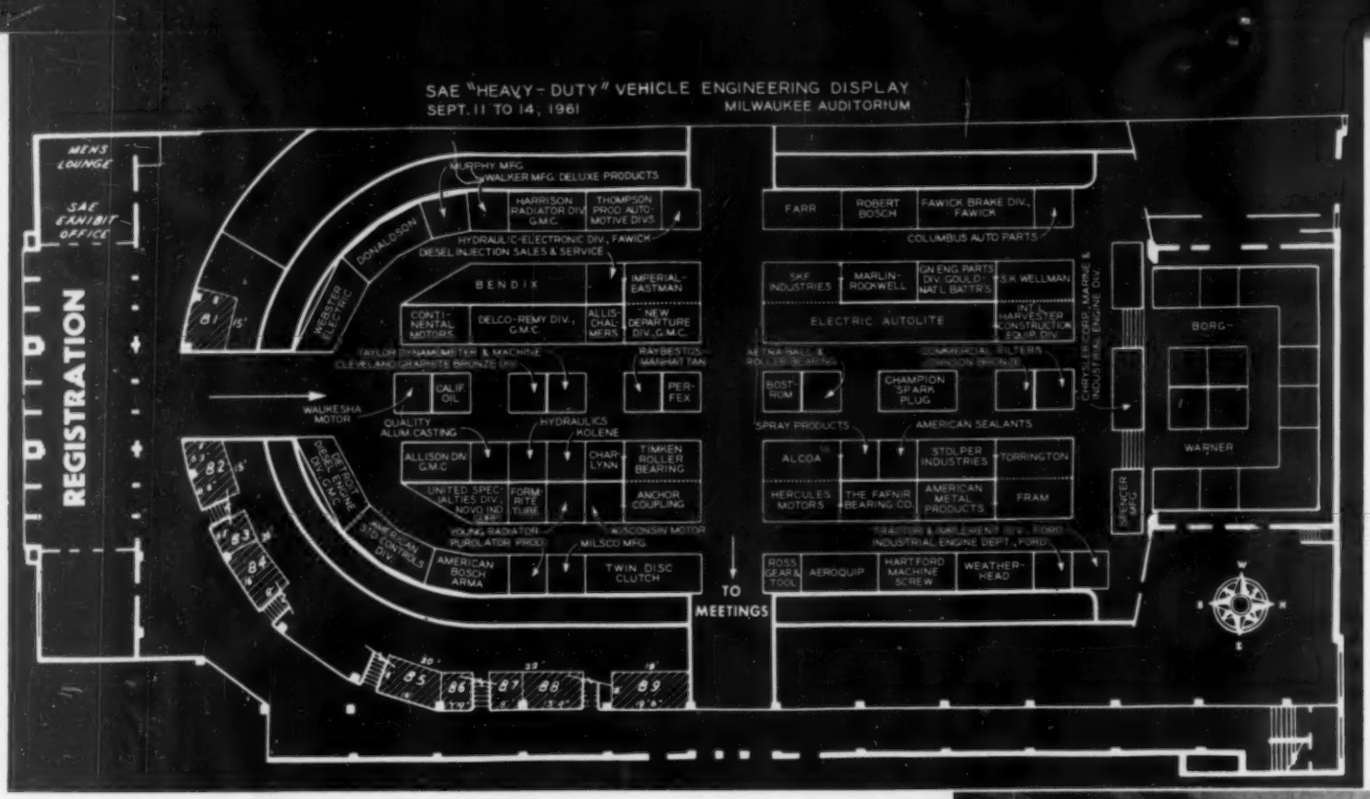
Technical Sessions—A great deal of work has gone into the preparation of the sessions and the top caliber of the papers, authors, panelists, and the timeliness of their subjects is impressive. The entire list of technical sessions is presented at the end of this article.

Production Forums—Always a popular feature at the Milwaukee meeting, the forums will take a detailed look at new techniques and advanced production methods like "The Role of Electronics in Production Control," "Tape Controlled Machining," "Aluminum Casting Techniques," "Coordinating Sales Forecasts with Building Requirements," "Production Schedules and Financial Forecasting," to name a few.

Engineering Display—The display area in the Milwaukee Auditorium and adjoining halls has been a complete sell-out with over 80 exhibitors utilizing 130 booths to graphically illustrate the latest in powerplants, power transmission equipment, filters, fuel injection systems, and other products of special interest to design and application engineers, production men, and equipment operators. In total, over 25,000 sq. ft. of floor space will be used to house this vast display.

There are many other features of the four-day meeting. On Tuesday, Robert G. LeTourneau, president of R. G. LeTourneau, Inc., Longview, Tex., will be the principal speaker at the luncheon. At that time, LeTourneau and the Firestone Tire and Rubber Co. will be given the Sperry

This view of two heavy duty diesel vehicles is indicative of the scope of this year's Milwaukee SAE Meeting in which five major activities will be participating.



Award. Speaking on behalf of the Sperry Board of Award, Robert E. Lea stated, "The Elmer A. Sperry Award for 1961 is made jointly to R. G. LeTourneau in recognition of his development of large capacity, high speed, automatic earthmoving equipment, and to the Research and Development Division of the Firestone Tire and Rubber Co. in recognition of its pioneering the giant size, heavy-duty tires which made such equipment feasible." At the luncheon, Kurt F. Wendt, dean of the College of Engineering, University of Wisconsin, will be the toastmaster. The speaker Tuesday evening at the annual banquet will be Edwin F. Sweetser, director, Office of Guided Missiles, Department of Defense.

R. G. LeTourneau

In addition to the technical sessions scheduled for Wednesday, two plant tours have been arranged. The morning tour will be of A. O. Smith Corp. where special attention will be given to their facility for heat-treating truck and bus frames. In the afternoon, Waukesha Motor Co.'s plant will be toured with emphasis on their production and assembly of many models of diesel, gas, and gasoline engines.

Here is the complete list of technical sessions four-day meeting:

MONDAY, September 11

9:00 a.m., **Plankinton Hall**

WHAT'S NEW IN FARM TRACTORS
Chairman: E. M. Brumbaugh, Mgr., Agricultural Engrg., J. I. Case Co.

- **Development of a Hydraulically Shifted Tractor Transmission**
  L. E. Elfes, Dir., Engrg., North America Massey-Ferguson Ltd.
- **4-Wheel Drive Tractor for Large Farms**
  W. J. Askins, Project Engr., The Frank G. Hough Co.
- **Ford 6000 Tractor**
  C. T. O'Harrow, Ch. Tractor Engr., C. B. Richey, Ch. Research Engr., and B. G. Burnside, Supv., Engine Design Section, Tractor Engrg. Dept.; Tractor & Implement Div., Ford Motor Co.

9:00 a.m., **Engelmann Hall**

FAMILY OF MILITARY ENGINES
Updated information on small military standard engines.
Chairman: Ralph Botos, Asst. Ch., Support Equipment Branch, U. S. Army Engineer Research and Development Laboratories

- **New Military Design Engines**
  G. R. Conrad, Ch. Engr., Research & Development Div., Continental Motors Corp.; R. F. Dennis, Ch., Gasoline Engine Section, and W. A. Summerson, Sr. Project Engr., Gasoline Engine Section; Support Equipment Branch, U. S. Army Engineer Research and Development Laboratories

2:00 p.m., **Plankinton Hall**

WHAT'S NEW IN FARM IMPLEMENTS
Chairman: R. C. Frevik, Asst. Ch. Implement Engr., Implement Engrg. Dept., Tractor & Implement Div., Ford Motor Co.

- **Three Point Hitch Mounted Corn Picker and Picker-Sheller**
  D. D. Dankel, Ch. Engr., Agricultural Equipment, Motec Industries, Inc.
- **How to Drive It; How to Steer It—The Self Propelled Conundrum**
  John Borland, Ch. Engr., Transmission & Axle Div., Rockwell-Standard Corp.; and D. C. Heitshu, Product Design Mgr., New Holland Machine Co. Div., Sperry Rand Corp.
- **A New Concept in Farm Loaders**
  D. J. Campbell, Product Design Engr., Tractor & Implement Div., Ford Motor Co.

MONDAY, September 11

4:30 p.m., **Plankinton Hall**

CREATING TIME THROUGH TEST ENGINEERING
A color film produced by Farm Equipment Engineering and Research Center, International Harvester Co.

2:00 p.m., **Engelmann Hall**

SMALL ENGINES—FOREIGN AND DOMESTIC
Chairman: L. I. Frisbie, Ch. Engr., Chassis Section, Farm Equipment Research, Engineering Center, International Harvester Co.

- **Small European Engines, Status and Recent Developments**
  W. E. Meyer, Prof., Mechanical Engrg., The Pennsylvania State University
- **Climatic Control for Air Cooled Engines from Tropic Heat to Arctic Cold**
  J. A. Gresch, Design Engr., and R. D. Beard, Experimental Engr.; Wisconsin Motor Corp.

TUESDAY, September 12

9:00 a.m., **Plankinton Hall**

NEW TRACTOR ENGINES
Chairman: K. L. Pfundstein, Mgr., Agricultural Engrg., Ethyl Corp.

- **John Deere Sleeve and Deck Engines**
  W. H. Nordenson, Asst. Ch. Engr., John Deere Tractor Research & Engineering Center; and Russell Candee, Ch. Product Engr., John Deere Dubuque Tractor Works; Deere Manufacturing Co.
- **Development of Oliver's New Gasoline Engines**
  T. H. Morrell, Ch. Engr., and K. S. Minard, Project Engr.; The Oliver Corp.

9:00 a.m. **Kilbourn Hall North**

SECONDARY BRAKE SYSTEMS
Chairman: R. K. Super, Exec. Engr., Brake Div., Rockwell-Standard Corp.

- **Parking Requires Brakes, Too**
  R. E. Dix, Test Engr., Bendix Products Div., The Bendix Corp.
- **Emergency Brakes**
  R. F. Burris, Experimental Engr., and A. D. McLean, Staff Engr., Design; Kenworth Motor Truck Co. Div., Pacific Car & Foundry Co.
- **Retarders for Highway Vehicles**
  E. C. Maki, Ch. Engr., Axle & Transmission Section, Advanced Engrg., Motor Truck Div., International Harvester Co.

LUNCHEON
12:00 Noon, **Juneau Hall**

Speaker: Robert G. LeTourneau, President, R. G. LeTourneau, Inc., Longview, Tex., who will speak on: "FRICTION, As It Pertains to Machinery, Men, and God."

Presentation of Elmer A. Sperry Award to R. G. LeTourneau, and to the Research and Development Division of The Firestone Tire and Rubber Co.

All Day, **Engelmann Hall**
GAS TURBINE CONTROLS

Morning: 9:00 a.m.
Chairman: L. E. Johnson, Asst. Dir., Research, Caterpillar Tractor Co.

- **Analog Computer Simulation of Gas Turbine Engines for Control Study**
  V. L. Larrowe, Head, and M. M. Spencer, Asst. Head; Analog Computer Lab., Institute of Science & Technology, The University of Michigan
- **A Literal Acceleration Limiting Fuel Control for Gas Turbine Engines**
  A. N. Carras, Mechanical Engr., Grovar Dept., AiResearch Manufacturing Co. Div., The Garrett Corp.

- **Breaking Ground for Low Turbine Costs with Simple Controls**
  H. C. Zeisloft, Staff Engr., Engine Controls, AC Spark Plug Div., General Motors Corp.

Afternoon: 2:00 p.m.

- **The Trend in Fuel Control Systems for Small Gas Turbines in England**
  J. S. Clarke, Ch. Engr., Joseph Lucas Ltd.; C. K. J. Price, Ch. Engr., Lucas Industrial Equipment Ltd.; and C. H. Bottoms, Dir., and Ch. Engr., Lucas-Rotax Ltd.
- **The Design and Development of Two New Industrial-Type Fuel Controls**
  F. W. Newburgh, Mgr., Small Gas Turbine Control Dept., and Bruce Ingold, Sales and Service Engr.; Woodward Governor Co.

2:00 p.m., **Plankinton Hall**

OIL ADDITIVES—WHAT DO THEY DO?
Chairman: J. A. Drais, Supervising Engr., Research Chemistry, Caterpillar Tractor Co.

- **Oil Additives—Friend of the Equipment Designer**
  L. W. Manley, Supv., Lubricants Development, and N. V. Messina, Supervising Technologist; Research Dept., Paulsboro Lab., Socony Mobile Oil Co., Inc.
- **Additives in Lubricants**
  Peter Kalil, Technologist, Research & Technical Dept., Texaco, Inc.

WEDNESDAY, September 13

9:00 a.m.
PLANT TOURS

9:00 a.m.—Buses will leave Milwaukee Auditorium for tour of A. O. Smith Corp.

1:30 p.m.—Buses will leave Milwaukee Auditorium for Waukesha Motor Co.

9:00 a.m., **Kilbourn Hall**

PACING ENGINEERING DEVELOPMENT
Chairman: R. W. Beal, Dir., Engrg., U. S. Army Engineer Research and Development Laboratories

- **Is Creative Design Being Shackled by Production Inertia**
  T. G. Timberlake, Ch. Engrg. Dept., U. S. Army Engineer Research and Development Laboratories
- **The High Pressure Hydropneumatic Suspension of the Universal Engineer Crawler Tractor**
  R. K. Reynolds, Asst. Ch. Engr., and Edward Mayer, Project Engr.; Government Engrg. Section, Construction Equipment Div., International Harvester Co.

9:00 a.m., **Plankinton Hall**

POWER STEERING
Chairman: B. G. Rich, Ch. Product Engr., John Deere Waterloo Tractor Works, Deere Manufacturing Co.

- **Full Fluid Steering Control**
  D. F. Morgan, Product Mgr., Power Steering, Char-Lynn Co.
- **A New Power Steering System for Tractors**
  E. H. Fletcher, Project Engr., John Deere Research & Engineering Center, Deere Manufacturing Co.

9:00 a.m., **Juneau Hall**

COMBUSTION AND RESEARCH
Chairman: L. D. Evans, Product Engr., Construction Equipment Div., International Harvester Co.

- **Control of the Combustion of Compression Ignition Engines**
  A. R. Ibrahim, Acting Dean, High Industrial Institute for Teachers, and E. T. Vincent, Prof., Mechanical Engrg., The University of Michigan
- **Swirl and Combustion in Divided Combustion Chamber Type Diesel Engines**
  H. Kakimoto, Research Assoc., Mechanical Engrg., The Pennsylvania State University; and Instructor, Mechanical Engrg., Kyoto University; and F. Nagao, Prof., Mechanical Engrg., Kyoto University

9:00 a.m., **Engelmann Hall**

TRUCK DRIVELINE VIBRATIONS
Chairman: R. E. Fletcher, Ch. Engr., Mechanical Transmission Div., Dana Corp.

- **Some Aspects of the Truck Drive Train Vibration Problem**
  M. C. Kaye, Dir., Research & Development, Freightliner Corp.
- **Prepared Discussion:**
  R. C. Norrie, Gen. Mgr., Kenworth Motor Truck Co., Div., Pacific Car & Foundry Co.
  G. W. Feil, Divisional Ch. Engr., Design & Specifications, Motor Truck Div., International Harvester Co.
  H. R. Pickford, Asst. Ch. Engr., Charge of Heavy Trucks, Dodge Car & Truck Div., Chrysler Corp.

2:00 p.m., **Plankinton Hall**

UNIVERSAL JOINTS AND DRIVELINES
Chairman: E. R. Fryer, Ch. Product Engr., Scrapers, Euclid Div., General Motors Corp.

- **Drivelines for Heavy Equipment**
  J. A. Kayser, Ch. Engr., Universal Joint Div., Dana Corp.
- **Application of Universal Joints to Construction and Industrial Machinery**
  W. T. Condon, Project Engr., Twin Disc Clutch Co.

2:00 p.m., **Kilbourn Hall**

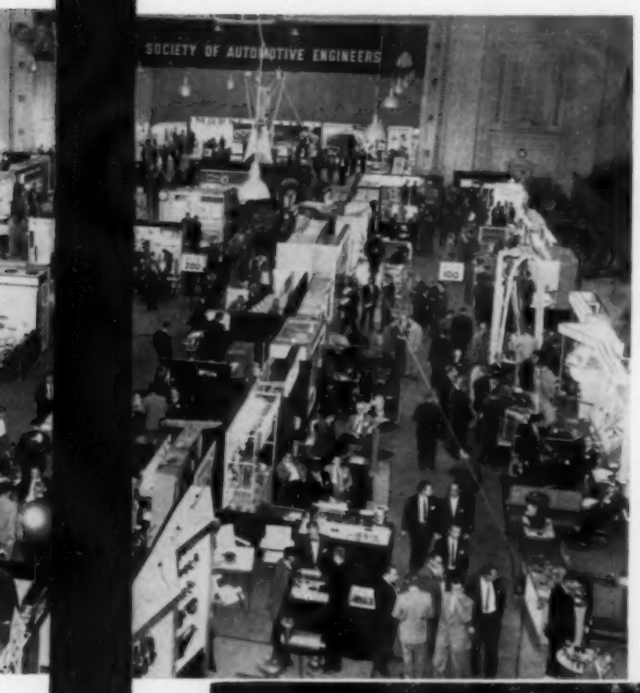
INDUSTRIAL DESIGN IN FARM EQUIPMENT
Chairman: J. A. Miller, Vice Pres., Engrg. Research & Development, Motec Industries, Inc.

- **Machine to Man or Man to Machine**
  Henry Dreyfuss, Industrial Designer, Henry Dreyfuss
- **Farm Equipment: A Growing Challenge for the Industrial Designer**
  John Gale, G. T. Scharfenberg, and J. N. Polivka, Partners; Scharfenberg, Polivka, Gale, Inc.

2:00 p.m., **Juneau Hall**

FORK LIFT DEVELOPMENT
Chairman: D. W. McKee, Dir., Engrg., Industrial Truck Div., Clark Equipment Co.

- **Automatic Controls for Materials Handling**
  O. S. Carlise, Mgr., Engrg., The Yale & Towne Mfg. Co.



Overall view of the Auditorium display area at the 1960 Milwaukee meeting. Over 80 exhibitors will present their products and/or services at the upcoming September meeting.

Several important technical sessions will be devoted to wheel and crawler tractors. Development of the new diesel for this Case 310 crawler is presented in this issue.

- **Fork Truck Stability Design Criteria**
  L. K. Jensen, Product Engr., Gas Fork Trucks, Clark Equipment Co.

2:00 p.m., **Engelmann Hall**

ENGINE OIL ANALYSIS VS. SCHEDULED OIL CHANGES
Chairman: D. B. Albrecht, Group Engr., Sales Technical Div., The Standard Oil Co. (Ohio)

- **Engine Oil Analysis as a Management Tool**
  Capt. R. S. Stewart, Technical Asst. to Asst. Ch. of Bureau of Naval Weapons, Department of U. S. Navy
- **Our Experience in Using an Oil Analysis Program**
  R. E. Bruce, Vice Pres., and Fleet Supt., Harold E. Richardson, Inc.; and R. J. Lewis, Staff Engr., Shell Oil Co.

THURSDAY, September 14

9:00 a.m., **Plankinton Hall**

FORK LIFT TRANSMISSIONS
Chairman: A. G. Heisel, Gen. Supervising Engr., Caterpillar Tractor Co.

- **A New Power Train for Mobilift Fork Lift Trucks**
  R. B. Singer, Ch. Vehicles Engr., Motec Industries, Inc.
- **Fork Lift Truck Drives—Straight Stick to Hydrostatic**
  W. M. Shaffer, Staff Research Engr., Towmotor Corp.

9:00 a.m., **Walker Hall**

SOIL MECHANICS
Chairman: C. T. Langley, Marketing Mgr., Mather Spring Co.

- **Predicting Equipment Performance in Soils from Scale-Model Tests**
  C. J. Nuttall, Jr., Pres., Wilson, Nuttall, Raimond Engineers, Inc.; and R. P. McGowan, Mechanical Engr., U. S. Army Transportation Research Command, Department of U. S. Army
- **Soil Bins and Instrumentation for Research and Evaluation Applications**
  W. L. Harrison, Jr., Ch., Applied Land Locomotion Mechanics Section, Research & Engrg. Directorate, Ordnance Tank-Automotive Command

9:00 a.m., **Kilbourn Hall**

HOW TO CALCULATE DIESEL BEHAVIOR
Chairman: J. J. Ford, Gen. Mgr., Fuel Injection Div., Hartford Machine Screw Co. Div., Standard Screw Co.

- **Some Steps Towards Calculating Diesel Engine Behavior**
  A. E. W. Austen, Dir., and Ch. Engr., and W. T. Lyn, Principal Research Officer; C. A. V. Ltd.

9:00 a.m., **Engelmann Hall**

HEAT TREATED TRUCK FRAMES
Chairman: H. R. Pickford, Asst. Ch. Engr., Engrg. Div., Chrysler Corp.

- **The Role of Heat Treated Side Rails in the Trucking Industry**
  R. K. Wawrousek, Ch. Metallurgist, Parish Pressed Steel Div., Dana Corp.
- **Light Weight Frames by Machine Quenching**
  G. J. Kuchera, Exec. Engr., and R. A. Panlener, Asst. Gen. Sales Mgr.; A. O. Smith Corp.

9:00 a.m., **Juneau Hall**

PARTS REPLACEMENT, SALVAGE, AND MAINTENANCE REPAIR QUALITY CONTROL
Chairman: I. W. Rhodes, Deputy Dir., Motor Equipment Management Div., General Services Administration

- **Parts Replacement—Milage Vs. Condition**
  S. E. Robinson, Jr., Fleet Engr., Central Truck Lines, Inc.
- **Parts Salvage—When Does it Pay to Rebuild Worn Parts?**
  C. T. Doman, National Service Mgr., and Reginald Rice, Asst. National Service Mgr.; Ford Div., Ford Motor Co.
- **Quality Control and Remanufactured Parts**
  C. G. Bauer, Corporate Dir., Quality Control, Chrysler Corp.

2:00 p.m., **Plankinton Hall**

POWERSHIFT TRANSMISSIONS
Chairman: E. O. Martinson, Vice Pres., Research & Development, Koehring Co.

- **Engineering the New Twin Disc Powershift Transmission**
  J. B. Snoy, Ch. Engr., Transmissions, Twin Disc Clutch Co.
- **Powershift Transmissions for Earthmoving Equipment**
  G. W. Eger, Asst. Ch. Engr., Caterpillar Tractor Co.

2:00 p.m., **Juneau Hall**

CRANE TEST PROCEDURES
This paper is designed to provoke discussion of the impact of the proposed stability determination on present-day crane ratings.

Chairman: E. B. Nicklos, Vice Pres., Engrg., Manitowoc Engineering Corp.

- **Crane Load-Stability Test Code**
  Paper based on work and authored by members of Sub-Committee XVII Crane Testing Procedures. To be presented by F. J. Strnad, Vice Pres., and Ch. Engr., Link-Belt Speeder Corp.

2:00 p.m., **Kilbourn Hall**

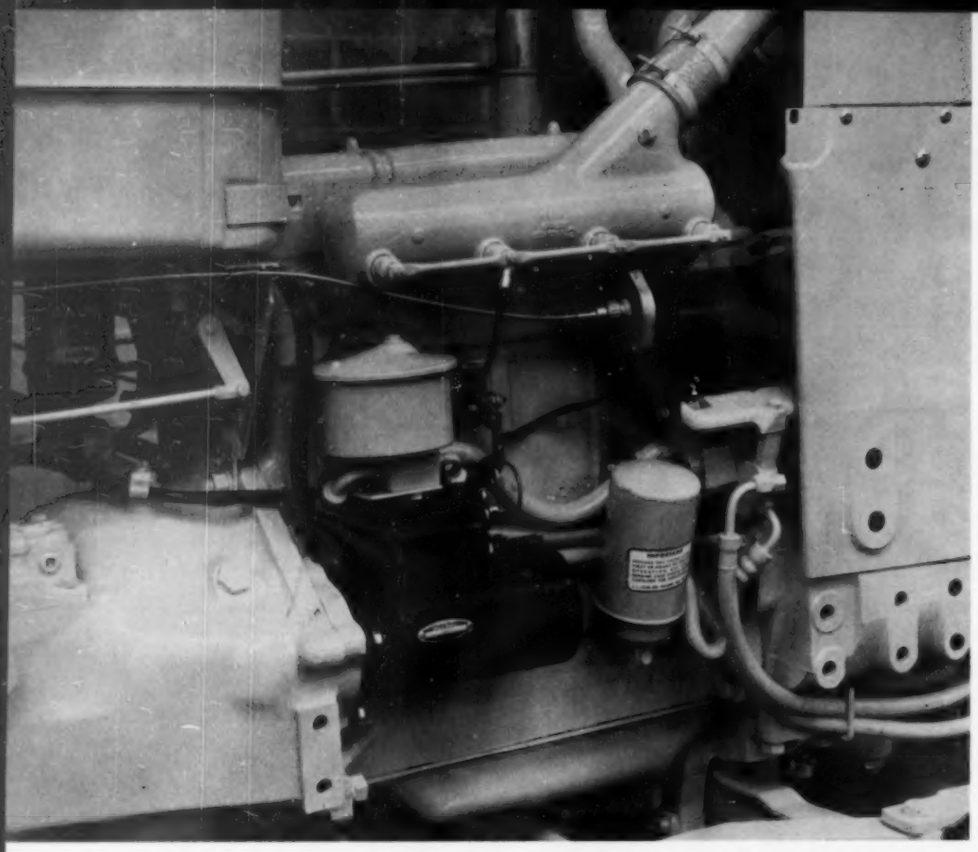
ALUMINUM OFF-HIGHWAY ROCK BODIES
Chairman: H. V. Parsley, Divisional Ch. Engr., International Harvester Co.

- **The Development of Aluminum Off-Highway Rock Bodies in Canada**
  R. A. Esmonde, Sales Development Engr., Charge of Road Transport Development, Aluminum Company of Canada, Ltd.

2:00 p.m., **Engelmann Hall**

DUPLEX TIRES
Chairman: J. J. Robson, Dir., Tire Development, The Firestone Tire and Rubber Co.

- **A New Dimension in Tires**
  R. P. Powers, Mgr., Tire Testing & Advanced Engrg., The Firestone Tire and Rubber Co.
- **On Highway Use of Duplex Tire**
  E. B. Ogden, Dir., Maintenance, Western Region, and R. W. Kupp, Tire Research Engr.; Consolidated Freightways, Inc.
- **Duplex Tires Off the Highway**
  R. C. Norrie, Gen. Mgr., Kenworth Motor Co. Div., Pacific Car & Foundry Co.



View of W3D industrial tractor installation with sheet metal removed to show intake manifold with four electric manifold heater elements. A hydraulic steering pump is mounted off the new front accessory drive. Electrical equipment is Delco-Remy. The Roosa Master fuel filter with glass sediment bowl is installed on bottom of fuel tank.

SIMPLICITY MARKS NEW J. I. CASE TRACTOR DIESEL

By WILLIAM P. MYERS*

WHEN J. I. Case Company decided to develop a diesel engine for the smaller wheel and crawler tractors, three design requirements were immediately apparent. First, in order to be interchangeable with its companion spark ignition engine, it was necessary that the diesel engine have the same overall dimensions, engine mountings, accessory drives, fan location, water and exhaust connections, plus comparable performance. Second, in order to minimize tooling costs, both spark ignition and diesel engines were to be produced with the same machine tools. Third, in order to be competitive in its size class, extensive effort would be necessary to reduce costs by simplifying the design and at the same time obtaining high output with best possible operating economy.

The design program resulted in a four cylinder, four cycle, naturally aspirated diesel engine designated as model G188D. It incorporates wet sleeves, direct injection, a 17.5:1 compression ratio, a $3\frac{3}{4}$ in. bore and $4\frac{1}{8}$ in. stroke giving a total displacement of 188.4 cu. in. The engine has a dry weight of 662 lbs. with flywheel and accessories. Typical performance of the G188D engine for its various applications in the J. I. Case tractor line is listed in the following table:

Tractor Model	Rated RPM	Horsepower	Torque (Ft. Lbs.)	Fuel Consumption Lbs./Hp Hr.
430	1750	40.5	121.5	.375
530	1900	48.5	134.1	.390
530C	2100	52.5	131.3	.395
630	2000	56.5	148.4	.410
630C	2250	61.0	142.4	.415

These are bare engine figures with the torque and horsepower readings corrected to standard conditions of 29.92 inches of Hg and 60° F.

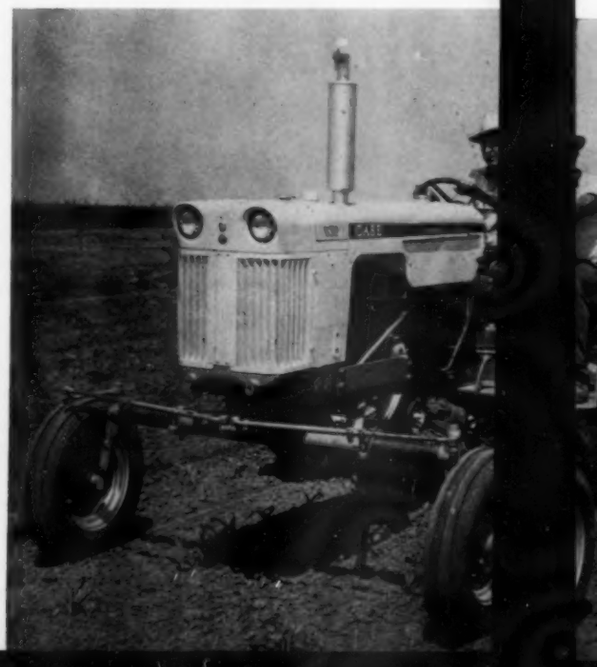
Use of common tooling for spark ignition and diesel engines did not in any way influence the ruggedness of the diesel design. To illustrate, the diesel is 54 lbs. heavier than its gasoline counterpart and has five main bearings compared to three for the gasoline engine. Although the diesel is sturdier throughout, many of the machining dimensions such as bolt patterns, block length, drilled oil passages, cylinder, crank and can bores are the same for the two engines. Further advantage is gained by using common parts for such non-critical items as oil pan, valve cover, rocker arms, oil filters, seals, gaskets and water pump components.

Early in the design program, a study was made to reduce manufacturing costs by incorporating more functions into fewer parts, thus minimizing machining operations. As an example, the front casting on the engine serves as a gear cover, injector pump mounting, water pump housing, water outlet and thermostat housing. This casting has few milled surfaces and requires only one set of production fixtures. The decision to use a direct injection open chamber combustion system was in agreement with the design requirements. Since no additional parts are necessary to control combustion, the machining of the cylinder head is simplified. G188D dynamometer and field tests have shown the capabilities of this open chamber type of design for high output with low fuel consumption.

Several design features of the air induction system contribute to the low fuel consumption. Placing the exhaust manifold on the opposite side of the engine from the intake manifold improves volumetric efficiency by minimizing heat transfer to the incoming air. The oversized intake manifold and individual intake passages in the head insures equal and unrestricted breathing to each cylinder. More important, the design of the intake air passages and valve ports induces high air swirl in the combustion chamber without impeding the air flow. This feature was the result of static flow tests of various experimental valve port and air passage configurations. The aluminum alloy piston has a toroidal combustion chamber and is

Left hand side of engine. Note that exhaust manifold provides for either an upright or an underslung exhaust system. Roosa Master pump is horizontally mounted.

The Case 630 is the largest of the three wheel-type farm tractors using the G188D engine. With standard transmission, it is a 56.5 hp unit and with the Case-o-matic torque converter, it furnishes 61 hp.

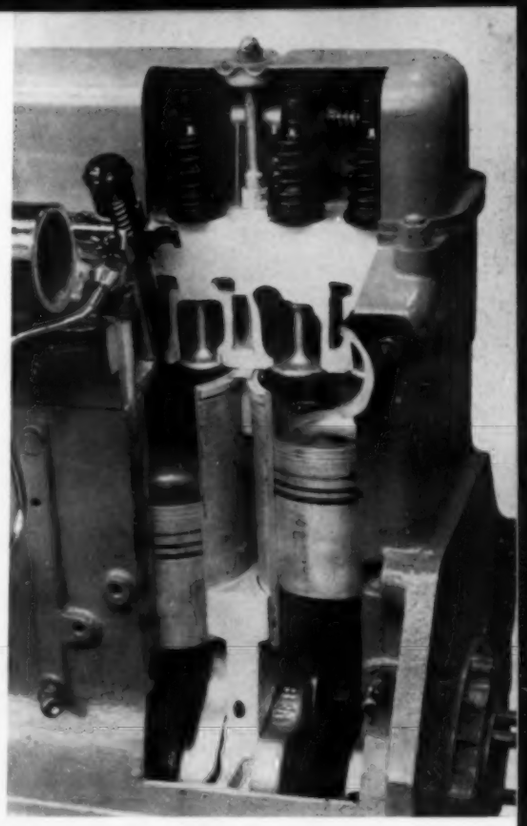


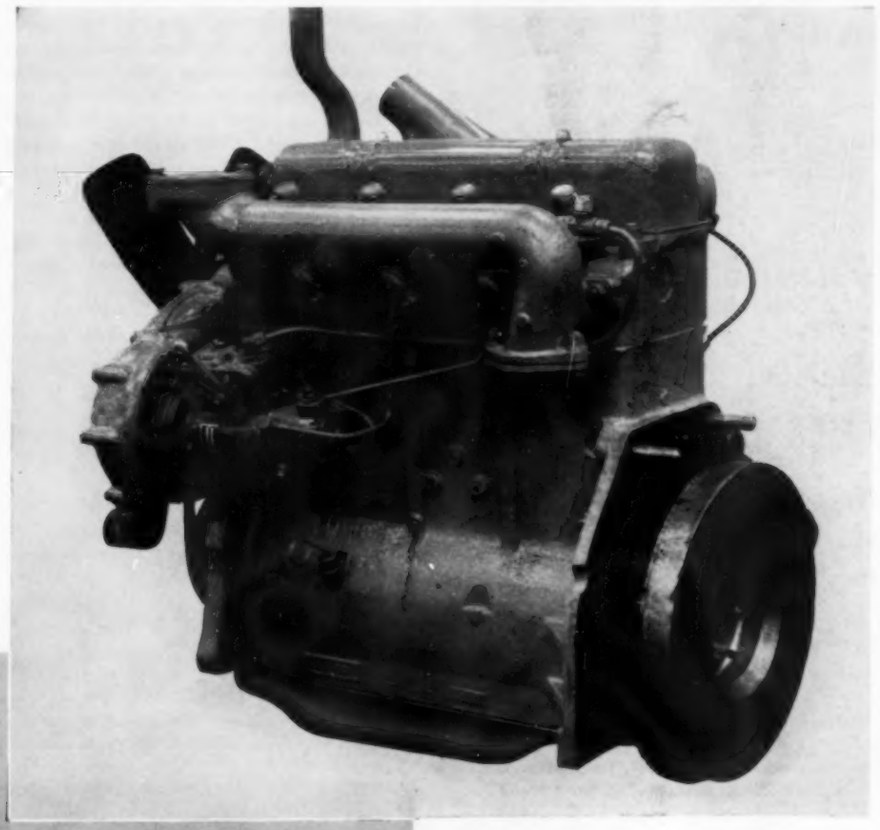
Supervisor, Diesel Engine Design, Rock Island Works, J. I. Case Co.

fitted with a chrome plated keystone top ring, a flat compression ring, and an oil ring. The full floating piston pin is retained with snap rings and is offset $\frac{1}{16}$ in. to minimize piston slap. The inner surface of the replaceable wet cylinder sleeves extends above the upper flange for head gasket protection. The bottom end of the sleeve is sealed with two "O" rings.

The C1046 forged steel crankshaft is fully counterweighted and has induction hardened journals. The $2\frac{7}{8}$ in. dia. main bearing journals and the $2\frac{1}{16}$ in. dia. connecting rod bearing journals provide considerable overlap for good rigidity. The bearing liners are steel-backed copper-lead with flanged center main for end thrust. Cylinder block is heavily ribbed in both the water jacket and the crankshaft area for maximum structural strength. The bearing cap bolt holes in the crankcase are heavy bossed and deep counterbored to eliminate high stress concentrations around the main bearings. Bearing caps are ductile iron with deep I sections to withstand high combustion loads.

Full flow filtration and internal oil passages are some of the features of the lubrication system. The gear type oil pump is driven off the crankshaft gear and has a float oil inlet screen and an integral pressure regulating valve. The oil filter is a standard automotive type with an internal by-pass valve and a screw-on mounting for easy replacement. Drilled passages carry the oil from the filter to an oil gallery where it is admitted to the main bearings. The crankshaft is rifle drilled to pressurize the connecting rod bearings and spurt holes in the rod maintain a lubrication film on the cylinder walls. The front camshaft gear journal and also the idler gear journal are pressure lubricated with spurt holes to meter the oil to the front gear train. The rocker arm shaft is lubricated through vertically drilled passages in the block and head.





Cutaway view shows C.A.V. injectors set at 20° angle, injector nozzle liner and combustion chamber configuration. Note that the water baffle in the upper part of the cylinder head directs the water flow around the valve port walls.

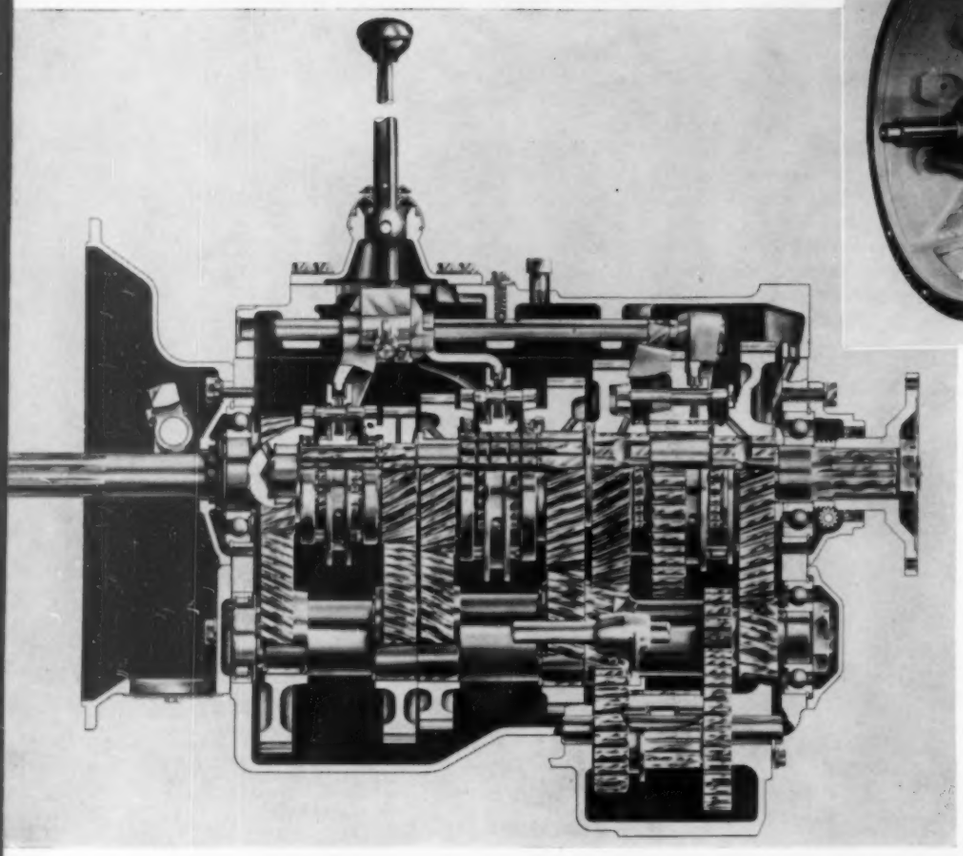
Valve system features a five journal cast iron camshaft with flame hardened lobes, wide faced valve lifters, pearlitic malleable rocker arms, and replaceable valve guides. There is a single intake and exhaust valve for each cylinder. All valves are recessed flush with the bottom surface of the head and alloy steel exhaust valve seat insert is used for long life.

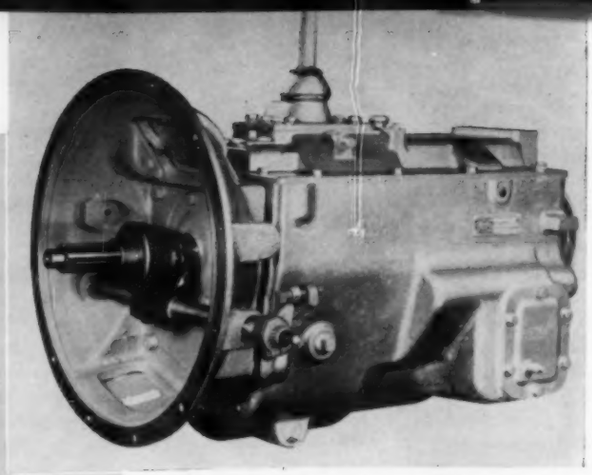
The timing gear train provides a location for an accessory drive on the camshaft side of the engine, while on the other side of the engine, the idler gear drives the injection pump. The injection pump drive gear is assembled on the pump supported drive shaft in order to eliminate additional bearings, shafts, and couplings. The standard internal coupling of the Roosa Master injection pump permits easy removal of the pump, leaving the drive shaft and gear with the engine. The Roosa Master injection pump features a mechanical governor, a delivery valve, and an automatic advance which contributes to good starting characteristics, high torque back-up, and optimum performance at all speed ranges. The C.A.V. injectors are installed at 20° angles with the vertical, have four .009 diameter holes, and are set for 2250 psi opening pressure. A No. 2 fuel is used for most operating conditions.

The present applications for this engine consist of crawler tractors, loaders, combines, power units and industrial and agricultural wheel tractors with both dry clutches and torque converters. The acceptance of the G188D diesel engine is resulting in an increasing share of the total engine production at the J. I. Case Rock Island Plant.

Cooling efficiency was a major consideration in the design of the cylinder head. Stainless steel liners permit the nozzle injectors to be completely surrounded by water and also allow more area for circulation around exhaust and intake valve seats.

The water inlet to the engine as well as the water outlet are located in the cylinder head. The coolant flow is directed between the valve ports by a cast-in baffle in the upper part of the head. A belt driven, high capacity centrifugal pump provides circulation and a thermostat with fixed by-passes controls the temperature.





Six-speed, model 5662 "Direct on sixth" Dana-Spicer transmission with helical, constant-mesh gears in all forward speeds at top; and to left a cutaway drawing of the new transmission.

SIX-SPEED TRANSMISSION ADDED FOR OTR SERVICE

New Unit for Vehicles in 60,000 GCW Range Added by Dana; Also a More Simplified Retarder and New Four-Speed Auxiliary

By JIM BROWN

JUST about a year ago the Dana Corporation brought out a new extra heavy-duty 5-speed transmission designed primarily for service in large, higher horsepower diesel trucks. Since then a number of additional new products have been released by the Toledo, Ohio manufacturer which are of particular interest currently in the trucking and transportation field. Included are a new constant mesh 6-speed transmission; a new 4-speed auxiliary transmission; a more simplified-mounting speed retarder; and a new 6000 series transmission case with an 8-bolt power take-off aperture designed to provide for higher PTO torques for operating heavier equipment.

New Six-Speed Transmission

Fitting neatly between the Dana-Spicer 4-speed and 5-speed transmissions and the 12-speed Synchromaster, the new Dana-Spicer 6-speed transmission just announced was designed primarily for service in over-the-highway trucks. Designated as model 5662, this new transmission is nominally rated at 375-400 lbs./ft. torque. It features direct drive in sixth gear, a low gear ratio of 8.23:1 and is said by Dana to be ideally suited for vehicles in the 60,000 lb. gcw range. Its gear ratios are as follows:

Forward					
1st	2d	3d	4th	5th	6th
8.23:1	4.56:1	2.80:1	1.85:1	1.32:1	Direct

Reverse—8.25:1

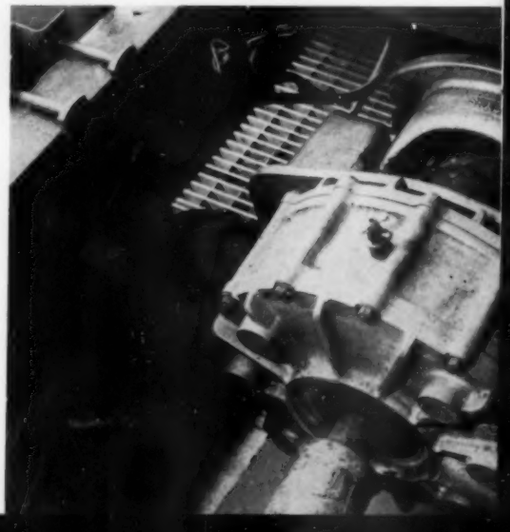
The new 6-speed transmission is available with a remote-control cover arrangement and a shifter assembly to extend outward on either the right or left-hand side, with control rods extending either to the front or rear. The transmission was designed for use with Spicer 14 or 15½ in. single plate clutches, and provision is made for clutch adjustment through the bottom of the clutch housing. Dana will assist with information on the installation of this transmission with other makes of clutches. Provision is made in the rear bearing cap for installation of speedometer drive gears and a standard SAE 6-bolt aperature is provided on both sides for side-mounted power takeoffs.

All gears in the new transmission (except the reverse gear) are helical, constant-mesh gears and the top five speeds are fully synchronized to render smooth, fast shifts. Weight of the transmission is 415 lbs. without clutch. Clutch housing sizes are SAE No. 2 or No. 3 and companion flanges can be furnished and assembled by Dana for all Spicer universal joints.

Besides being suitable for new trucks in the 60,000 lb. gcw range, Dana engineers point out that this new 6-speed transmission can be used advantageously to replace 4-speed and 5-speed transmissions in trucks where a wider range of gears is needed—also in some vehicles now fitted with supplemental gearing which is not being fully utilized.

4-Speed Auxiliary Transmission

Another recent Dana product is the model 7041 4-speed auxiliary transmission for use on vehicles and equipment with engines in the 400-600 lbs./ft.



torque output range. Nominally rated at 550 lbs./ft. torque, the 7041 auxiliary transmission filled a gap between Dana-Spicer's model 6041 and model 8341 4-speed auxiliary transmissions. The model 7041 auxiliary transmission attains quiet operation and ease of shifting throughout by the use of constant-mesh, helical gears. It weighs only 340 lbs. and has an overall length of $25\frac{3}{16}$ in.

The model 7041 auxiliary transmission was designed for use with standard 4 or 5-speed transmissions in the 400-600 lbs./ft. torque range. Dana-Spicer representatives point out that it has excellent ratio splits in the top three gears. Shifting is accomplished at the same rpm in these splitter gear positions, resulting in the maintenance of maximum engine horsepower during the shifts. Gear ratios currently provided in the 7041 auxiliary transmission are as follows:

1st	2nd	3rd	4th
2.31:1	1.21:1	1:1	0.83:1

An important feature of this auxiliary transmission is that it makes available a Spicer top-mounted power takeoff or "Power Tower" capable of transmitting full engine torque, when the forward transmission is in direct drive. As in the case of the main transmissions, the model 7041 makes provision for the installation of speedometer gears. The transmission is also available with a main shaft bearing cap which will accommodate the Bendix transmission brake. Companion flanges can be furnished and assembled by Dana for use with Spicer universal joints. While transmitting a relatively high torque, the Spicer model 7041 auxiliary transmission makes available to the trucker four times as many gear ratios as is afforded by his single main-power transmission, and more than doubles the low-gear starting torque which can be applied to the axle.

New Spicer-Thompson Retarder

Over-all operation of the original Spicer-Thompson speed retarder was covered in the July, 1960 issue of DIESEL AND GAS ENGINE PROGRESS. However, Dana has since come up with a new version, a shaft-mounted retarder which reduces installation costs, eliminates two of the four previously required universal joints, eliminates a variety of mounting brackets previously needed and results in a more compact, more efficient installation. In effect the new retarder, which mounts on the back of the transmission case, becomes an integral part of the driveline assembly.

According to the manufacturers, operators of vehicles with minimum-length drivelines can now install this compact retarder without difficulty, as it fits propellor shafts of nominal lengths as short as $13\frac{3}{4}$ in. between transmission and axle joint centers. The new two-piece bracket by means of which the retarder is mounted on the transmission provides rubber-padded trunnions which ensure the preservation of propellor-shaft joint angles during the transmittal of power from the transmission to the axle, and which transfer the retarder braking reaction torque to the vehicle frame via the transmission and engine case.

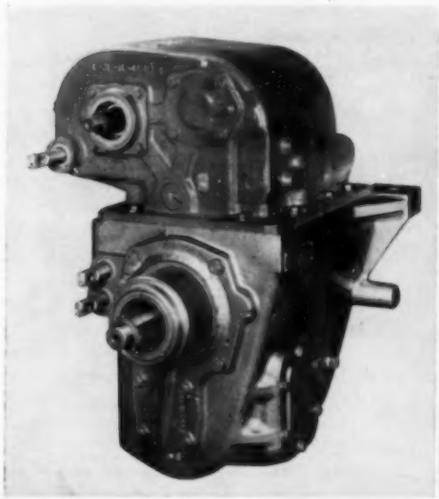
Built primarily of aluminum, the Spicer-Thompson retarder was designed for use with any of the Spicer 4-speed to 12-speed transmissions, but is compatible with other makes of transmissions with comparable ratings. Its maximum braking output is 900 hp at 2400 rpm. It is offered for field installation complete with all necessary controls and accessories which include an oil reservoir, air-operated hydraulic loading cylinder, heat exchanger, propellor shaft and stub yoke, etc.

Dana points out that the new retarder provides increased safety through improved control of speeds in both over-the-highway and off-highway operation. With growing emphasis on faster schedules, increased payloads and greater economy in vehicular operation, retarders such as this are cited as a solution with important possibilities in situations where conditions such as critical loads, steep grades or heavy traffic prevail.

Transmission With 8-Bolt PTO

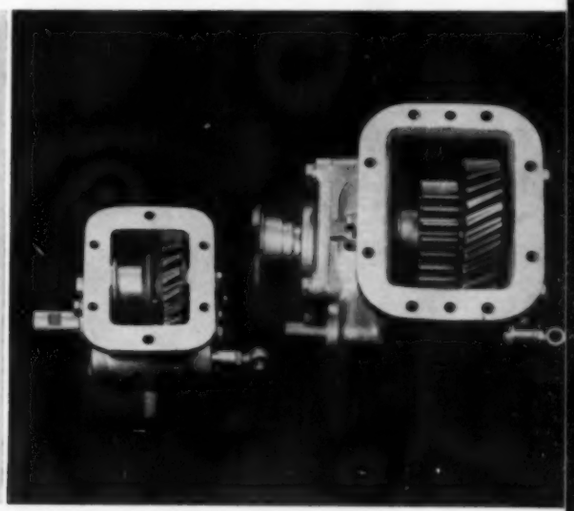
Another new development in the power transmission field recently announced by Dana is a new 6000 series Spicer transmission case which features an 8-bolt power takeoff aperture to accommodate high-torque, side-mounted P.T.O. installations on vehicles in the 175 to 225 hp range. Designed to withstand the high torque and horsepower necessary to operate such heavy-duty equipment as cement and fluid solid blowers, earth-boring augers, large winches (30,000 lb. capacity and over), centrifugal pumps, hydraulic pumps, air compressors and similar equipment, the new case is available on production model 5-speed transmissions in the 6000 series, or as a replacement assembly for existing units. It is readily interchangeable with the standard 6-bolt aperture case now in the field. In addition to the new 8-bolt aperture on the right-hand side, the case is designed with a 6-bolt aperture on the left side. An adapter plate, which permits changing the 8-bolt aperture to 6-bolt is also available, further increasing the versatility of the unit. Standard 6-bolt PTO's mounted to this adapter provide faster speeds and appreciably more horsepower than from former installations.

New 4-speed auxiliary transmission with top-mounted "Power Tower".



New 6000 Series Dana-Spicer Transmission with 8-bolt PTO aperture.

From left, the 6-bolt and new 8-bolt side mounted power take-offs.



New Spicer-Thompson retarder mounted in a truck chassis.

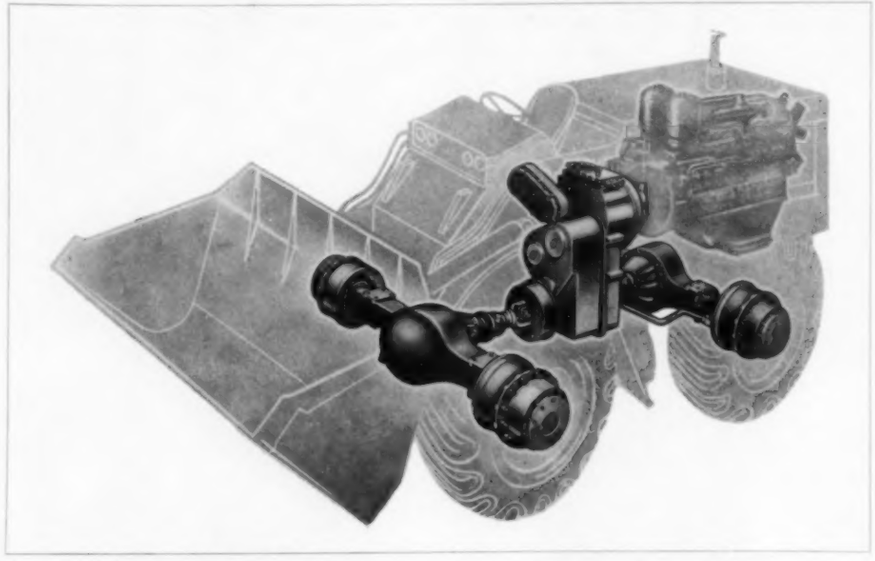
PLANETARY LINE GROWS TO MATCH AXLES TO LOADS

In Tailoring Planetaries to Meet Drive and Capacity Requirements of Heavy Duty Vehicles, Rockwell-Standard's Axle Size Range Expands Quickly to Nine Basic Models with Almost Infinite Ratio Variations

By ROBERT E. SCHULZ

DURING the last half-dozen years, many changes have taken place from the engine to the axle in material handling equipment, off-highway trucks and haulers, and other heavy duty industrial vehicles. Sparked by the need for larger machines with capacities better tailored to meet individual operating requirements, the development of new power and drive components has been nothing short of dynamic. Introduction of the heavy duty planetary axle during this time is a case in point and in a few short years, they have moved from limited application to a position of "standard" for all types of heavy-duty service vehicles—two or four wheel drive.

The Transmission and Axle Division of Rockwell-Standard Corp. has played a prominent role in the development of these heavy-duty planetaries, but of principal importance here is the Division's "complete line" approach to ensure proper matching of axles to machine and job requirements plus a look at important design features. To cover this in detail, we met with John Borland, Chief Engineer of the Transmission and Axle Division's Oshkosh, Wis., plant where all the company's planetary axles are produced. According to Borland, the full line concept, while it did not materialize until the mid-1950's, had its roots in work accomplished by the Timken-Detroit Axle Co. (later to become a Division of Rockwell-Standard) back in the early 1940's when their first planetary for heavy duty application was built. The market, however, was not yet ready for this advanced thinking since large equipment was only in the formative stage. By the early 1950's, the larger equipment was being given serious consideration and some prototype axles were then built that embodied features and developments that were to set the pattern for the company's complete line of planetary axles, both in the rigid, and in the steering types.



Typical power train of a front-end loader showing rigid front and rear steering planetary axles. Transmission is the Rockwell-Standard BDB power-shift with four speeds forward, four reverse.

SPR-711 tandem planetary axles with 150,000 lb. capacity on Autocar 40-ton rear end dump truck.

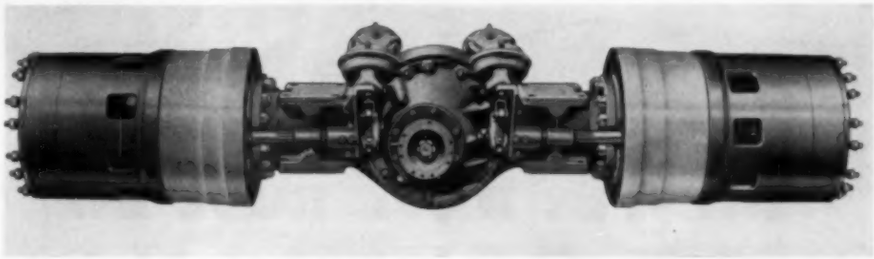
As originally conceived, the product program at Rockwell-Standard was to cover the application field with three basic heavy-duty axle models from 15,000 to 75,000 lbs. capacity with variations to meet particular requirements. "This never happened," Borland stated. "We had the overall capacity range, but requirements among the manufacturers of crane carriers, dump trucks and front end loaders in particular were such that it became immediately obvious that for proper matching, expansion within the line with primary and intermediate models was necessary." Thus

smaller and more economical axle shafts, differential units, and hypoid ring gears and pinions to be used. Also it enables Rockwell-Standard to develop each main component of the axle with a balance of value important to industrial and heavy duty truck applications.

The balanced planetary action is obtained by the use of a floating internal ring gear that is shouldered on the internal gear carrier (hub) and retained by a series of plates. This mounting, having a predetermined clearance, permits the internal gear tooth to float into the exact orbit formed by the three planetary pinions. The sun gear, mounted on the axle shaft or part of the axle shaft in some cases, likewise floats into the same planetary pinions. This design, combined with the floating ring gear, results in uniform loading on all three planetary gears and shafts. Note the wheel end section illustrated.

Thew-Lorain Moto-Loader ML-309 uses Rockwell-Standard series 250 rigid and steering planetaries plus BDB power-shift transmission.

Largest single axle planetary in the Rockwell-Standard line is this series-700 with a 75,000 lb. capacity.



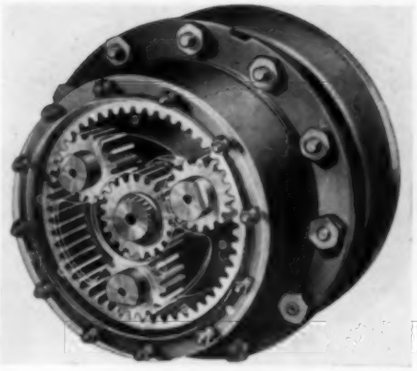
evolved the company's series of nine basic planetary axle models as follows: 50, 100, 150, 200, 250, 300, 400, 500, and 700. All nine models are built as rigid (PR) and steering (PS) axles and are available with from six to nine ratios. The model 200 with a nominal capacity of 20,000 lbs., for example, is available with eight ratios—14.8; 16.65; 19.03; 22.20; 24.60; 25.92; 26.64; and 28.08.

In matching the planetary axle to a machine, many factors take major consideration. "Probably the most important," Borland explained, "is the type of application—the axles carry different ratings for trucks, front end loaders, lift trucks, etc. For instance, in tractors, the torque load going into the axle is of primary importance, and in front-end loaders, it's the weight on the axle that counts. In addition, we must know the tractive effort and road speed required, and in the case of material handling equipment, where the steering axle will be located. On all applications, but particularly on off-highway vehicles, we need complete information of diesel engine and transmission." With this, plus data on any other machine operating requirements, Borland and his staff of engineers are able to select from their line, the axle and ratio which best meets the builder's (and the operator's) needs.

Rockwell-Standard planetaries are used extensively by many major heavy-duty equipment manufacturers such as Autocar, Koehring, Hough, Allis-Chalmers, Thew, Yale & Towne, Case, Hyster, and others, and applications vary from off-highway dump trucks and mining cars to heavy-duty fork lift trucks and four-wheel drive agricultural tractors. Number one market, however, is the front end loader and a typical axle arrangement using both rigid and steering planetaries is illustrated.

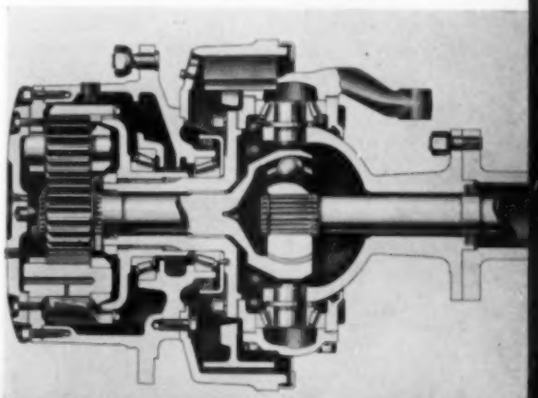
In addition, the company makes most of its rigid models available in series SPR tandem planetary axles which increases the application range of the line to 150,000 lbs. capacity. The general trend to tandems was started by the crane carrier builders; however, the first Rockwell-Standard tandem, a model SPR-700 with a 150,000 lb. capacity was built for Autocar in 1958. Since then, the market for tandem planetaries has expanded quickly with off-highway trucks and haulers of rated 40-ton capacities and over being the major users. The illustration of the Autocar model AP 40 rear end dump with the series SPR-700 tandem planetary is typical. For its line of tandem axles, both planetary and full floating types, Rockwell-Standard has recently introduced a new taper-leaf suspension system which employs only two, long tapered leaves in each spring. In this design, the thickness at the center of the two leaves is increased to the point where bending strength is equal to that of a multi-leaf spring. Thickness of the leaves then gradually tapers to each end, keeping correspondingly the same strength as the multi-leaf spring. Simplicity and less weight are the main features of the new system, coupled with quick and easy maintenance. The latter is attributed to a new spring attachment and a simplified spring seat assembly.

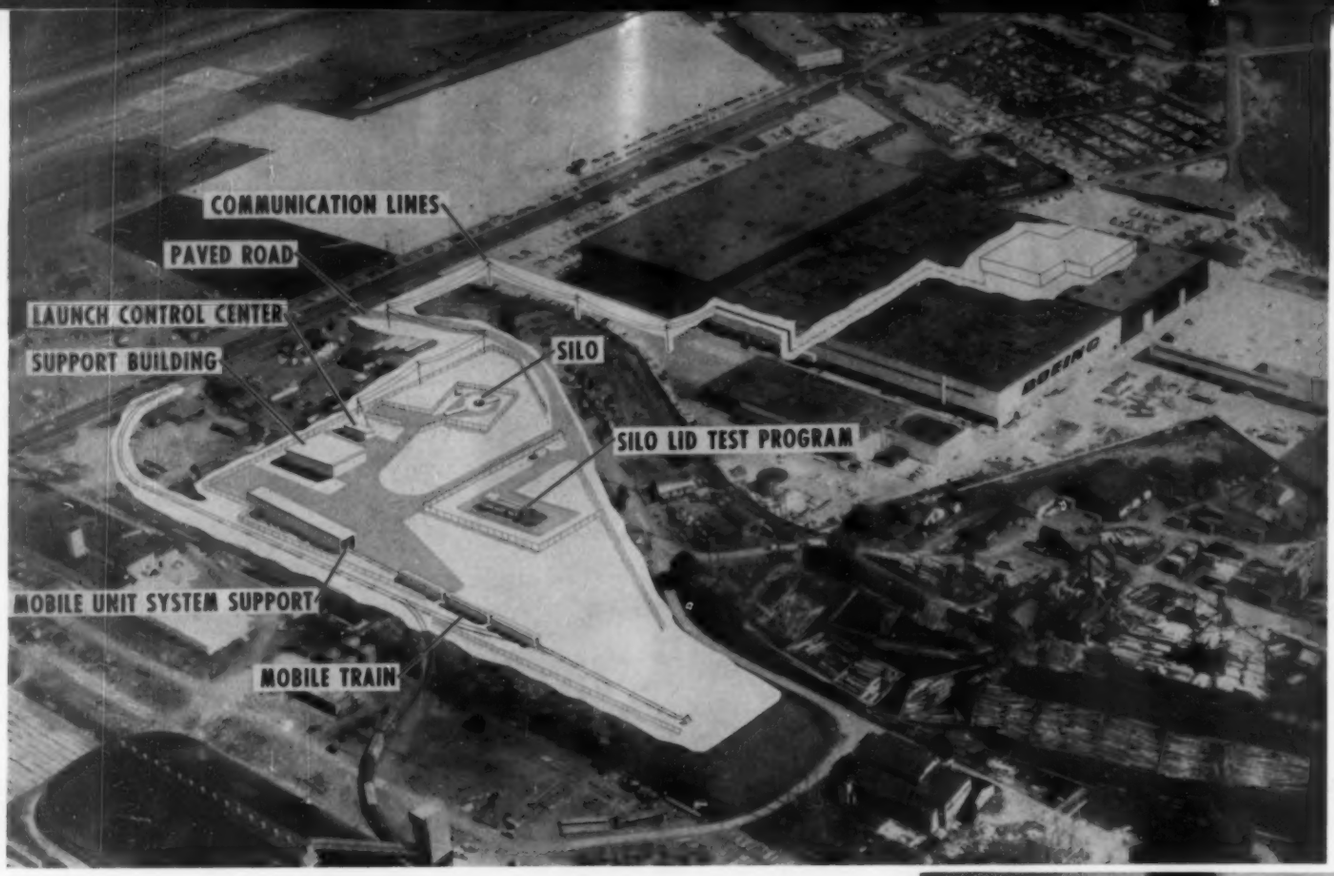
In the Rockwell-Standard planetary axle design, one of the main features is that a substantial balanced gear reduction is provided in the wheel hub. This hub, containing the planetaries, is nested within the wheel rims, as it is concentric, and has no offset such as a bull gear and pinion requires. Wheel end ratios range from 3.3:1 to 5.2:1, and these reductions allow substantially



Phantom view of wheel end showing floating ring and sun gears plus planetary pinions.

Sectional view of outer end of Rockwell-Standard's planetary steering axle.





DIESELS HAVE ROLE IN MINUTEMAN INSTALLATION

By W. J. GRANBERG

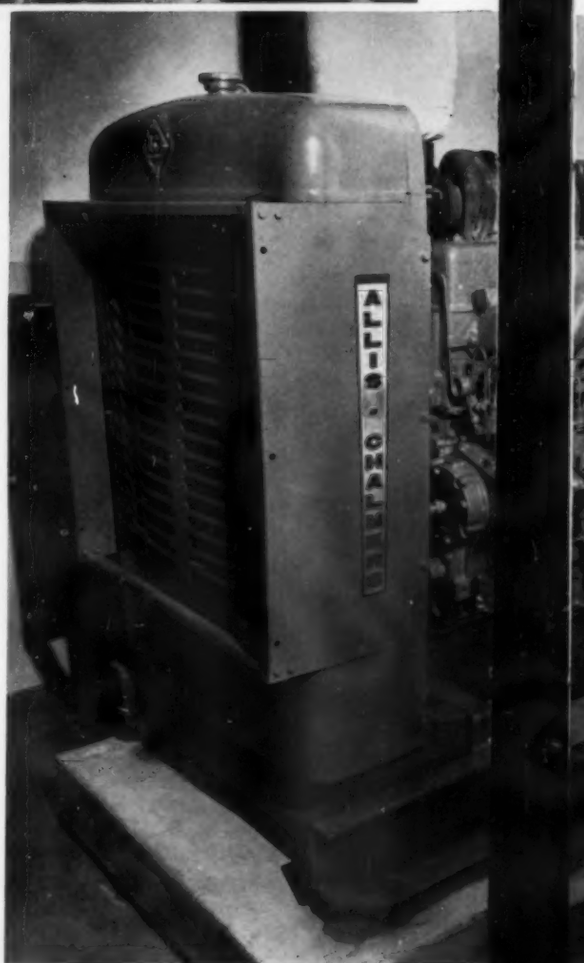
IF and when the Minuteman ballistic missile takes off on a 6,000 mile wartime one-way trip as likely as not it will be a diesel that assisted at the start of its roaring flight. Odds for or against firing this Boeing Company weapon are incalcuable, of course, but before long, at launching sites across the nation, diesel-electric generator sets will be on guard against the eventuality of war.

A $5 million operational mock-up for all Minuteman systems has been completed by Boeing at Seattle, Wash., where equipment and installation procedures are being tested and crews trained. Underground missile launchers are being built near Great Falls, Mont., and a second site has been chosen near Rapid City, S. D. These systems will be patterned after the Seattle mock-up, complete with two diesel-generator units.

Although considerable secrecy will enshroud other sites and their technical details, it may be assumed some will be powered solely by diesel-electric generator units, while others, as in the case of Seattle and Great Falls, employ them as standby sources of power in event surface transmission lines serving the systems are knocked out. In either case the diesel installations will be much alike and thus the test site in Seattle is illustrative of the demands placed on the diesels and serves to demonstrate their role in the gigantic Minuteman missile program.

Briefly, a Minuteman launching site consists of two installations. First there is the 80 ft.-deep hole, or silo, the pit from which the 60 ft. weapon is fired. Lined with steel and reinforced concrete, the silo is 12 ft. in diameter generally, but at the 20- and 28 ft. levels it is 24 ft. across for installation of launching equipment.

The power supply set up is at the lower level. It consists of a diesel-generator set, batteries, and transformer-rectifiers. At the 20 ft. level is the electronic equipment which monitors the missile and sequences the actual firing routine. An 80 ton steel and concrete cap will be moved over the mouth of the silo in event of wartime emergency. The second installation in this complex is the launch control center (L.C.C.) which also



holds a self-sufficient electric power unit. At actual missile bases the L.C.C. will be under ground, but at the Boeing mock-up it is housed in a sheet metal structure above ground. Here conditions are duplicated as they will prevail at a launching base, complete to air conditioning and water cooling for preservation of electronic equipment in event of a scorched earth attack.

In the final analysis, firing of the Minuteman, wherever it might be, may depend upon power from the diesels. For that reason Boeing's specifications for diesel-electric generator units were much tighter than for commercial installations. For one thing, engines must have reserve power for quick starting, and for high-altitude operation. Generators must require a minimum of maintenance and be operational, trouble-free, regardless of climate, and from sea level to mountains, tropics to desert.

Since the electric power installations in the silo and launch control center are virtually identical, the latter will be described as typical, although uses to which the power is put differ, of course.

Here, in the Boeing test L.C.C., on a thick concrete base, stands a model 11000 six-cylinder Allis-Chalmers diesel-electric generator set. Although the commercial rating for this standard industrial type engine is 100 kw at 1800 rpm, tight specifications called for employing the model 11000 to drive a 75 kw generator in order to have a desirable reserve of power. The four cycle, turbocharged engine has a $4\frac{7}{16}$ in. x $5\frac{9}{16}$ in. bore and stroke. The power take-off is a Twin Disc dry clutch for direct drive.

The Allis-Chalmers brushless type generator has an Allis-Chalmers static voltage regulator mounted inside the generator yoke, with all components on a single panel in a small and compact assembly. This generator, while retaining characteristics of a conventional power plant, is free of brushes, commutators and slip rings. Maintenance thus is at a minimum, and since there is no dependency upon mechanical rectification, the brushless generator will operate in areas where conventional units may prove unreliable because of climatic conditions.

The magnetic-amplifier circuit of the generator makes possible a static voltage regulator that eliminates the maintenance associated with electro-mechanical devices. The regulator employs a Zener diode as the voltage reference. This silicon diode maintains stable inverse-voltage characteristics over varying frequency and temperature conditions, with reliability inherent in semi-conductor devices. The control panel is an Allis-Chalmers product, while accessories on the engine include Fram air filter, Penn oil and water thermostatic controls and Kim Hotstart. United Electric Co. meters and Westinghouse circuit breakers also are used in the engine room.

As has been said, the electric power systems for the silo and launch control center are virtually identical, so the following explanation will serve to describe both. The primary source of power is the surface transmission line serving the community, a facility that quite likely would be knocked out in event of enemy attack. Next there is the temporary power source afforded by eight C & D batteries which produce 28 volts. Should the primary source of power fail, the batteries are cut into the line automatically to serve until the diesel-electric generator sets are started. Once they are on the line, in the L.C.C. and silo, the batteries are cut out.

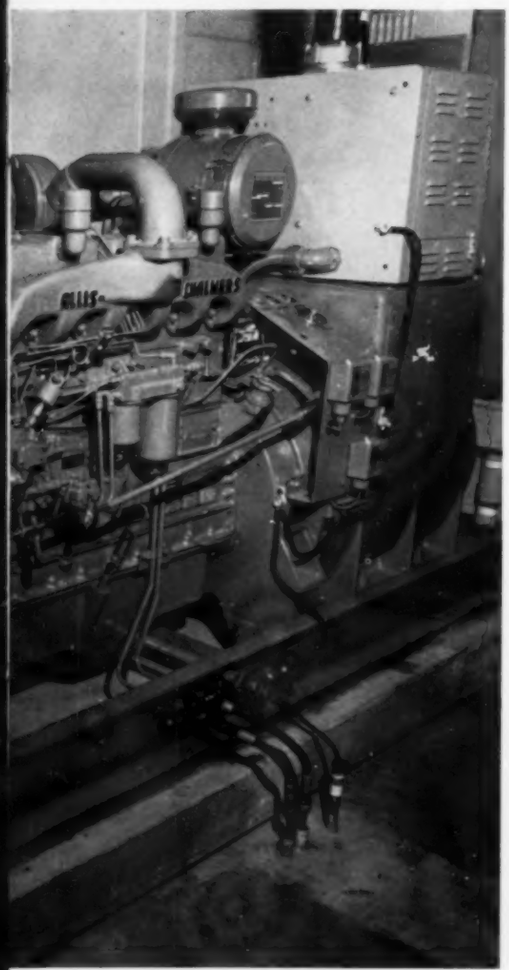
Power loads are shifted from their normal source to battery and generator units by automatic transfer switches which are equipped with complete engine starting controls. Since the temporary, emergency sources of power are batteries, and the final source the diesel-electric generator sets, double-throw transfer switches are employed. Two transfer switches are used at each installation and connections, which use no mechanical or electrical interlocking devices, provide that only one source of power can be connected to the load circuits at one time.

So much for the sources of power, and now for the somewhat intricate system in which they operate. The launching system itself operates on direct current, and the electronic equipment demands its own brand of power. These two facts tend to complicate things. The primary source of power, alternating current from surface transmission lines, feeds into a 400v transformer-rectifier and emerges as 28 volts dc to power a General Electric motor-generator set which feeds into 20- to 50-volt Siegler transformer-rectifiers. The emerging dc power, 28 volts, serves the Minuteman electronics system. The need for non-pulsing, unvarying supply of ac power for the final stage transformer-rectifiers to convert to dc is the reason for the motor-generator set.

In event of failure of the primary source of power, the battery circuit by-passes the 400v transformer-rectifier and powers the motor-generator. But only briefly, or until the diesel-electric generator sets go into action. There are demands for power, such as for lighting, other than the 28v dc emerging from the final stage transformer-rectifiers, and this is drawn off as ac earlier.

Layout of the Air Force Minuteman intercontinental ballistic missile launch complex of the Boeing Company at Seattle. No missiles will be launched from this operational mock-up where diesel engines serve as standby electric power sources in the launching silo and the launch control center.

Model 11000 Allis-Chalmers diesel-electric generator set is in the launch control center at Minuteman test site in Seattle. Power output of 75 kw will service control centers for the missile in event of failure of public power. Note Schwitzer turbocharger and Fram air filter.



In the heart of the Minuteman launching silo is this General Electric generator set, feeds into Siegler transformer-rectifiers to produce dc current for the ballistic weapon's electronic system. This set-up is duplicated in the launch control center.

DUAL FUEL ENGINE LEADS QUAKERTOWN, PA. TEAM

By DWIGHT P. ROBISON

A NEW Nordberg engine is leading the steam-diesel team at the Quakertown, Pa., municipal electric plant to the best production economy in the plant's long history. Burning gas at 51.74-cents per mcf and pilot oil at 9.69-cents per gallon, the new Duafuel unit is producing a kilowatt-hour at an average fuel cost of 5.27 mills for dual-fuel operation. In contrast, the total plant average for 1959 was 8.397 mills.

This municipal utility plant has been primarily steam since 1892 but with steady growth of this pioneer borough, larger steam engines were added, then turbines. The present plant was constructed in 1931 and went into service the next year utilizing a pair of 30,000 lb. per hr. boilers that are still in use. A 1,000 kw turbine purchased in 1928 was moved to the new plant. In 1937, a 2,000 kw GE turbine was added. In 1948, a 40,000 lb. per hr. boiler was installed. Two years later, the plant put in a 3.000 kw turbine.

Rapid growth in industrial, commercial and residential load soon called for some basic decisions on the future development of the plant. The borough specified diesels because they could be obtained and installed faster and represented a smaller investment. An additional bonus was the fact that a diesel could be started in a few minutes compared with three-quarters of an hour to put a turbine on the line.

In 1954, an 1100 kw diesel was installed in a building adjoining the steam plant. This was followed in 1957 by the plant's first dual fuel diesel, a 1050 kw unit. But Quakertown continued to boom and construction of a big new shopping center made it imperative again for the borough to go shopping for a power unit. The engine chosen was a 2,460 hp, 450 rpm Nordberg. This four-cycle Supairthermal V-type engine has 12 cylinders, 13½ in. bore and 16½ in. stroke and drives a 1750 kw GE generator with 17 kw V-belted exciter.

Acceptance tests showed that the new engine was indeed efficient, exceeding guarantees by a substantial margin. The new engine began to produce power early in May, 1960. Figures for the six month period from June 1 to November 30, 1960 show that the engine had run 2,176.9 hrs. and produced 2,778,531 kwh. Running on dual-fuel, the Nordberg consumed 25,459,000 cu. ft. of natural gas and 15,569 gal. of pilot oil. This meant an average of 9.162 cu. ft. of gas and 0.0056 gal. of oil per kwh. With gas at 51.74 cents a thousand cu. ft. and fuel oil at 9.69 cents a gal., this translates into an average fuel cost of 5.27 mills per kwh.

What this means in terms of plant economy can be seen by comparison of the first six months of operations with figures for the full year 1959. In that year, the steam turbines generated 20,068,000 kwh and the two diesels added 3,839,000 for a total of 23,907,000 kwh. The fuel bill included $174,122.33 for coal, $16,694.32 for fuel oil, and $9,837.84 for gas, making a total of $200,654.49 or 8.397 mills per kwh.

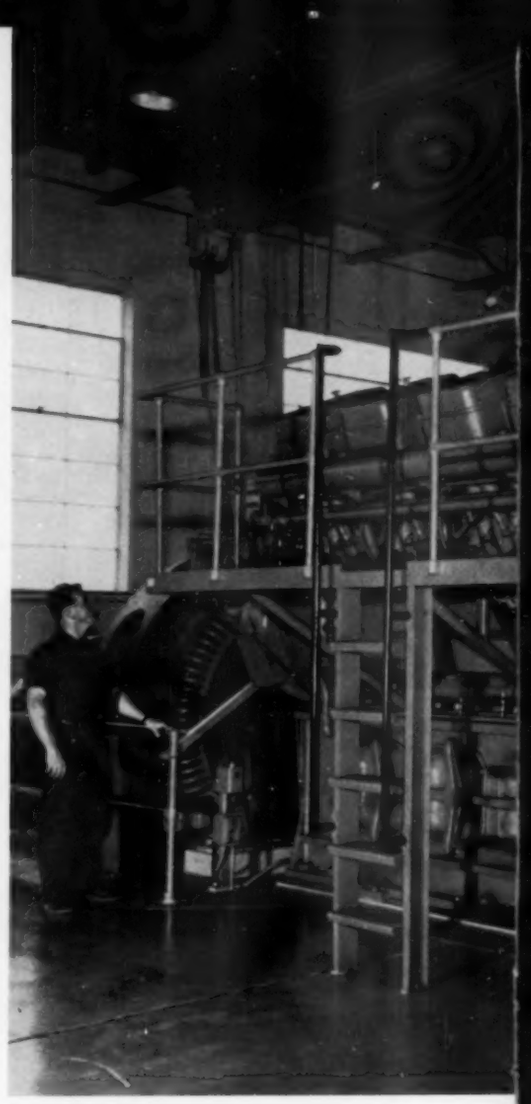
From June to November 1960, with the new engine handling 22 per cent of the load, turbine output was 9,600,000 kwh, diesel production 3,396,000 for a total of 12,996,000 kwh. The fuel bill was $79,159.82 for coal, $15,435.59 for gas, and $3,254.87 for oil, a total of $97,850.28 or 7.529 mills per kwh. This was a reduction of better than 2 per cent compared with the previous year, a saving of $2,476.97 on the fuel bill for the first six months.

The potential is even more impressive. Superintendent Robert M. Long is seeking every means of reducing generating costs, utilizing economical natural gas and, currently, experimenting with cheaper coal. With coal at $9.05 a ton, he finds he can turn out a kw hr in the steam plant for 7.834 mills. Even at this lower level, Nordberg Duafuel performance of 5.27 mills represents a 32.7 per cent saving.

The 3,000 kw turbine remains, of course, the base load generating unit and is in constant operation. The Nordberg is called on when load moves up to the turbine's capacity, then the 1050 kw unit. In practice, the new engine runs regularly from 7:15 am to 11 pm five days a week—sometimes six. In hot summer months, when the air-conditioning load is high, the unit is kept on the line till midnight. Currently, the plant hits its peak of about 5,000 kw just before noon and drops late at night to a low of 1,800 kw. The two smaller turbines serve as standby, for use when the big turbine is out of service.

All controls for the Nordberg are on a separate panel beside the engine. Buttons start the auxiliaries—the screw-type auxiliary lube pump and the centrifugal cooling water pumps. A pre-start button puts the engine in starting position, then a start button admits the air and fuel and turns her over. The start is blocked automatically, however, unless lube and cooling water and pilot oil pressure are up. Other buttons can be used to switch the unit from straight fuel oil to dual-fuel operation or the reverse. The panel also holds a full complement of gauges, an exhaust pyrometer, an inlet air controller, and alarm system.

Natural gas reaches the plant at just 5 lb. pressure and is boosted to 25 lb. by a motor-driven reciprocating compressor, after which it passes through an aftercooler and moisture separator, to bring gas temperature back to original inlet temperature before admission to the cylinders.

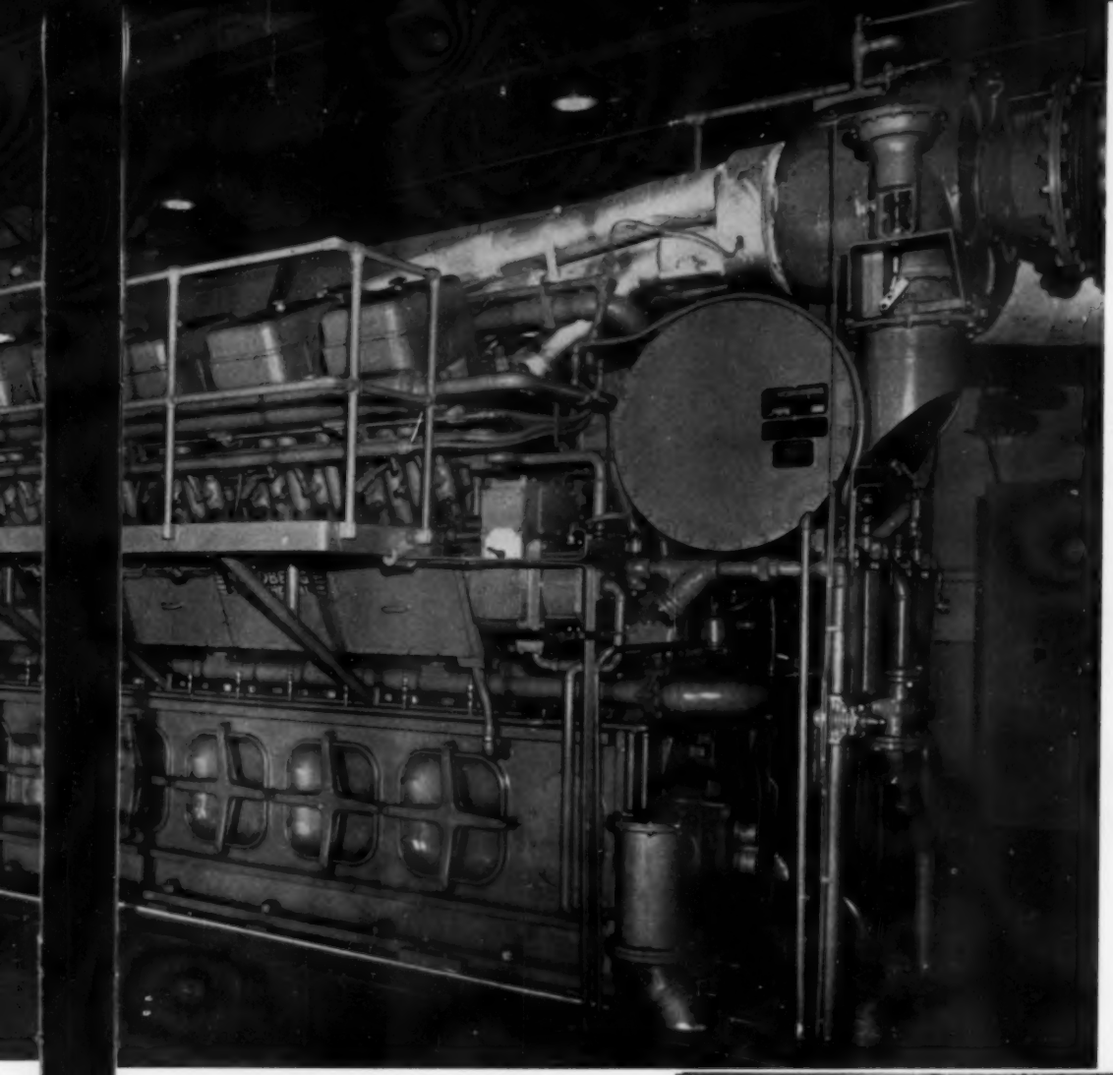


The main lube pump is engine driven and circulates oil to bearings and cylinders. Included in the system are a shell-and-tube oil cooler with automatic thermostatic bypass valve, a full-flow screen and a bypass cartridge-type filter. In the first six months, when the engine ran 2,177 hrs., only 510 gal. of oil were added, an average of 10,050 rated hp hrs. per gal. of lube.

There are four motor-driven cooling water pumps, two for jacket water and two for raw water, with one in each pair as a standby. The raw water pump sends the water through a heat exchanger and the oil cooler out to a two-cell induced-draft cooling tower which also serves the steam plant. The jacket pump sends soft water through the exchanger and the engine, with a thermostatic valve controlling temperature.

Engine air comes through an oil-bath filter on the roof, then an in-line silencer to the turbocharger, then through an intercooler to the intake header. The intercooler has its own automatically-controlled cooling water circuit. The starting air compressor also supplies air for the pneumatically controlled valves and safety devices.

The plant was designed by Borough Engineer Ralph L. Yanish who also held the post of



tribution to the community—free electricity for street lights, Borough offices, and other municipal facilities. The cost picture in 1959 was as follows:

Receipts from sales		$489,000.00
Expenditures:		
Generation	$284,700.00	
Distribution	28,600.00	
Administration	38,740.00	
Insurance	8,600.00	$360,640.00
Profit		$128,360.00

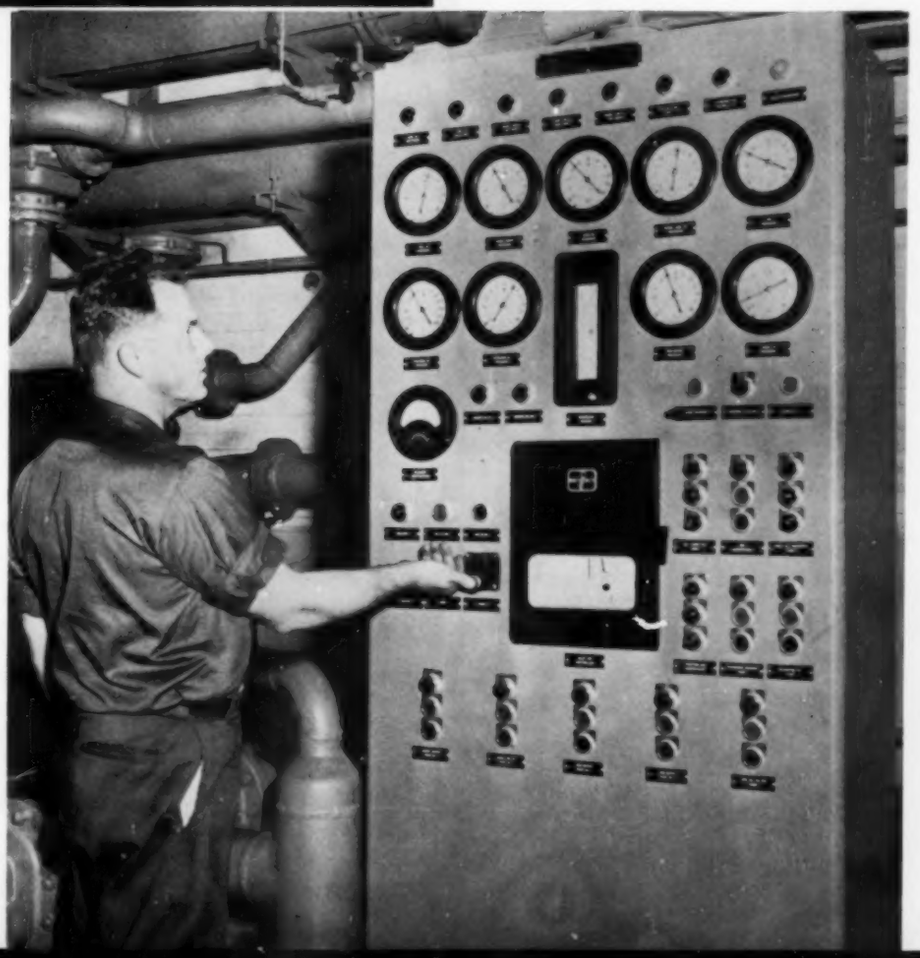
Not only is the plant free of tax support but the electric department shows a substantial profit and pays for new equipment on pay-as-you-go basis.

Principal Equipment Serving Nordberg Engine

Generator	General Electric
Governors	Woodward
Turbocharger	Elliott
Intercooler	Young
Silencers	Maxim
Air filter	American
Gas compressor	Ingersoll-Rand
Heat exchanger	Kewanee-Ross
Main lube pump	Roper
Oil cooler	Kewanee-Ross
Bypass lube filter	Hilliard
Lube strainer	Purolator
Thermostatic valves	Amot
Fuel filters	Purolator, Nugent
Exhaust pyrometer	Alnor
Turbocharger oil filter	Nugent
Starting air compressor	Quincy

Superintendent Robert Long inspects his new Nordberg engine. This V-type Supairthermal, four-cycle engine is rated at 2460 hp at 450 rpm. On test, the unit produced a kw hr at full load with fuel consumption of just 8,318 Btu. The engine is equipped with an Elliott turbocharger, Woodward governors and a Young intercooler.

On this panel beside the engine are buttons that start the auxiliaries, prepare the engine for starting, and actually put the unit in operation. Also on the board are Ashcroft gauges, an Alnor pyrometer, a Bristol air controller and a full alarm system.



Borough Manager. Pete A. Pakey is the present Borough Manager. Operations are directed by Plant Superintendent Robert Long.

Quakertown's growth has been steady, solid, and well-balanced and the electrical load shows this healthy balance. In 1959, electric sales were divided this way:

Type Consumer	No.	KWH	Billings
Residential	2,119	6,590,565	$215,324.31
Commercial	269	5,206,371	140,302.09
Industrial	43	6,242,796	130,620.53
Free	15	789,712	
Totals	2,446	18,829,444	$486,246.93

The free services of course, represent a con-

A factory-exchange Lipe clutch ready to go into an earthmover. Whenever practical, clutches are replaced when the engine is out of the truck.

CLUTCH MAINTENANCE ON QUARRY DIESEL FLEET

IN the final analysis, the dollar saved by a rigid vehicle maintenance program is every bit as important as the dollar earned through the sale of products. Such a program is in operation at the Jamesville, N. Y., quarry of Solvay Process Division, Allied Chemical Corp. And within this program clutch maintenance is one of the keys to reducing costs and keeping a fleet of 22 heavy diesel earthmovers on the go.

While but one of many truck components, it's amazing how many ills in a vehicle can be traced to a malfunctioning clutch. For example, an unbalanced clutch can actually cause excessive rear tire wear by transmitting vibration through the drive line. While this is an extreme instance, it's obvious that extra attention to this one critical part pays off by increasing the life of many other expensive truck parts.

After the waste rock is stripped limestone is quarried. Tractor-trailers transport limestone; straightside rear dumps the overburden. However, the 300 hp Cummins diesel unit is basically the same for either type of truck.

High in rolling hills seven miles southeast of Syracuse, N. Y. the vast Jamesville quarry handles 4½ million tons of limestone yearly including "chemical stone" for the main Solvay Process plant 15 miles from the quarry. Limestone, together with coal and salt, form the basic raw materials in the production of soda ash used in the paper, glass, textile, soap, paint, steel and aluminum-manufacturing industries.

Seven years ago the 22 dieselized earthmovers supplanted a standard gauge railroad in the job of hauling the limestone from the blast areas to the world's second largest rock crusher. Before the advent of the motorized off-highway fleet it was necessary to take up and re-lay standard gauge track whenever power shovels moved out of range. Not only was this time-consuming, but an accident or derailment virtually suspended quarrying for hours. The earthmovers consist of 11 straight-side-rear dump model 12DT, 22 ton capacity Euclids with 275 hp Cummins NH diesels and 11 semi units, these model 20TDT Euclids with Cummins 300 hp NHRS engines, of 36 ton capacity. All 22 Euclids have Fuller model 1120 transmissions.

Because the trucks haul the same loads over the same terrain at approximately the same distances, preventive maintenance has been placed on a time rather than mileage basis, as is the case with most off-highway fleets. Every 50 hours each truck is brought in for lubrication, oil change, engine tests, alignment and clutch inspection.

The maintenance crew receives double exposure to Lipe-Rollway clutches. They come as original equipment in the 300 hp Euclids, and Solvay Process uses an interchange program whereby worn 17 in. TC single plate clutches used in this truck are exchanged for identical factory rebuilt models. Steve Galt, Solvay quarry maintenance shop foreman, likes the factory-exchange program for five reasons: (1) new clutch guarantee, (2) Solvay Process saves money on the exchange because it receives core credits with each worn-out clutch returned to the local jobber, (3) when necessary, all-new replacement parts are used in a factory-exchange clutch, (4) every clutch is properly balanced at the factory and (5) mileage obtained is comparable to that delivered by a new unit.

The alternatives, of course, are rebuilding at the Solvay maintenance shop or sending them to a clutch rebuild shop. According to Galt, in view of time and labor consumed, savings aren't great enough to warrant his crew undertaking the task. At this point, many experienced fleet maintenance men interject a word of caution: use care in selecting the clutch rebuilder. Very few unfranchised

rebuilders possess the costly equipment to properly statically balance a clutch. And an unbalanced clutch can create havoc within the drive line. Nor may the shop be in a position to accurately determine the amount of spring fade, so important to the engagement and disengagement of a clutch. When a field rebuilder is used, care should be taken to select an authorized shop which completely rebuilds a clutch. Also, no matter what make of clutch is used the fleet owner should insist upon the use of genuine factory replacement parts.

If a clutch shows an appreciable amount of wear Galt has it replaced when the engine is out of the truck, rather than to bring the unit in a few thousand miles later for a separate job. Although this may sacrifice a small amount of clutch life the savings in time and labor can be substantial. Many over-the-road fleet operators adhere to this same policy.

And here's an illustration of how pinpointing attention to the truck's clutch saves even more labor time. Instead of assuming that the cause of forbidding vibration, for example, lies in either the drive shaft or the universal joint, a maintenance man first inspects the clutch for the source. Many otherwise experienced shopmen overlook this entirely until it is discovered by the lengthy process of elimination.

Galt's Cummins-trained diesel crew is also aware of the fact that poor clutch performance shortens engine life, and that it's almost a waste of time to provide perfect diesel operation if it's not transmitted up to the maximum. One simple preventive measure that should never be overlooked is the periodic adjustment of clutch pedal "free travel". Never let the clutch slip before making pedal adjustment because clutch facings quickly disintegrate once they become burned through slippage. In the clutch model used in the quarry off-highway fleet, for instance, "free pedal travel" should never be less than one-half inch, and to be correct should be one and one-half inches. The adjustment is simple. Most major manufacturers supply clutch service manuals, listing correct dimensions, for each type of clutch.

Good drivers are as effective as good maintenance men in prolonging clutch life. It's generally assumed that any man with the ability to handle a giant diesel truck or tractor is automatically a good driver. That's not always true. Many are basically fine drivers who have fallen into sloppy, careless driving habits. Therefore, driver training should be a continuing process. For example, heavy earthmovers, usually shifted properly with full loads, are often handled improperly when empty. High gross vehicle weights of huge tractors and trailers provide an ever-present burden with which the clutch must contend. It's vitally important that the driver does not shift into higher gears before the engine has reached a speed where it does not labor.

Failure to observe this principle results in impact, or shock-loading of drive line components from the clutch on through to the rear wheels. In some cases severe torsional shock is the result of this poor shifting practice. It has been proved that engine life suffers from this type of operation.

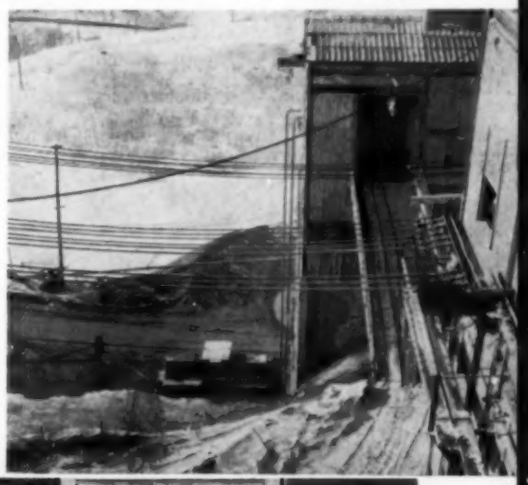
Every beginning driver is, of course, cautioned not to ride the clutch. But this bad habit still persists to a degree in the operation of heavy-duty vehicles; drastically shortening clutch life. Not only does it damage release bearings, but causes slippage, failure to transmit full power. Drivers of the 22 and 36-ton capacity Solvay Process vehicles are continually reminded of correct procedures, and, as a result, are extremely capable heavy-diesel operators.

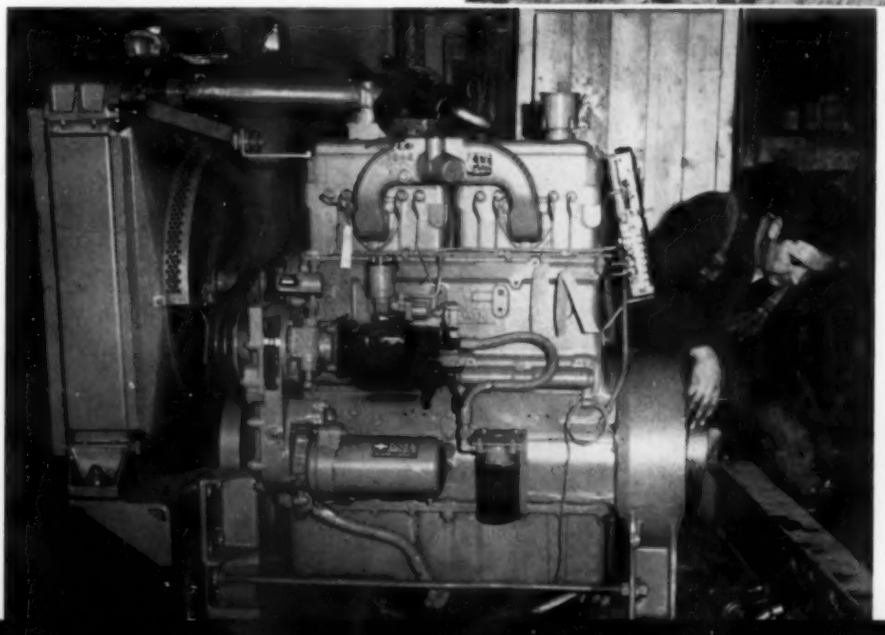
Drivers and mechanics, working together, can provide their company with an extra bonus—increased clutch life and lower replacement costs. The driver should promptly report clutch malfunctionings such as, slippage, failure to transmit power; chatter; grabbing; vibration; and failure to release properly; clashing gears. Prompt shop follow-up can remedy these ills when detected in their earliest stages. Andy Voytko, the quarry's master mechanic and overseer of all mechanical, sums it up by saying, "Half the battle is keeping on top of the maintenance load so that the unexpected doesn't become a severe setback". And in doing this, the clutch comes in for a great share of the attention.

Waste sandstone overburden is loaded into 22-ton capacity rear dumps, then hauled to waste dump areas. In addition to the limestone moved, millions of tons of this almost worthless overburden must be hauled each year.

"Down In the Valley" at the bottom of the crusher, rail cars are filled with crushed limestone for trip to main Solvay Process plant. Rail is the only feasible method of transportation because all routes to the main plant pass through thickly populated areas.

Renovated power crane will be powered by this new, compact model NH, 4 cylinder, 128 hp Cummins diesel which replaces a 30 yr. old, 130 hp gasoline engine four times its size.





IMPACT OF LARGER TRUCKS ON DRIVE COMPONENTS

KW-Dart, Major Off-Highway Truck Manufacturer, Reports on Move to Still Greater Capacity Vehicles and Power Train Design Needed to Meet Increased Torque and Load Requirements

IT is generally known that the pressure has been on manufacturers for many years to design larger hauling units. This demand has increased year by year for the last 25 years. Most operators of mining and quarrying equipment demand increased production with little or no increase in operating personnel. The answer, of course, is in the design of larger trucks, larger stripping and load shovels and related equipment.

To report the impact of these demands as they relate to truck haulage, the editors of this magazine contacted KW-Dart, one of the major builders of off-highway trucks whose line ranges from 10 to 100 ton capacity units. KW-Dart started with a 250 hp tandem axle 25-ton truck some 25 years ago and are now able to manufacture a truck which will carry four times as much load as its predecessor. By gradual steps, horsepower availability has been increased from the original 250 to the 700 hp diesel used in their biggest truck, the 95EDT.

In order to match the greatly increased horsepower now required, it has been necessary to design components capable of standing up under the increased torque and load. To achieve this, KW-Dart, working in cooperation with the Cotta Transmission Co., designed their own three and four-speed units. These transmissions normally operate behind Cummins diesels, the turbocharged 700 hp VT-12 engine, for example, in the 95EDT. The transmissions are coupled with Twin Disc three-stage torque converters which have a torque multiplication ratio of up to 6:1.

In the development stages, KW-Dart used a three-speed transmission and three-stage torque converter behind 450 to 600 hp diesels. This configuration placed the clutch between the engine and the torque converter which required preselection of the transmission gear as it could not be shifted on the fly. Subsequently a fourth (overdrive) gear was added to the transmission and the clutch placed between the converter and transmission. In addition to 25 per cent more speed, it was possible to shift this unit at any time. A countershaft brake adds to the versatility and ease of shifting.

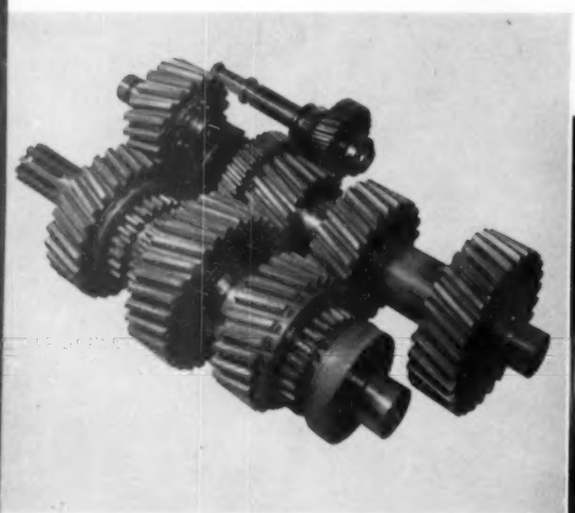
KW-Dart recommends that whenever possible a three-stage torque converter be used for the larger, higher horsepower trucks for three prime reasons:

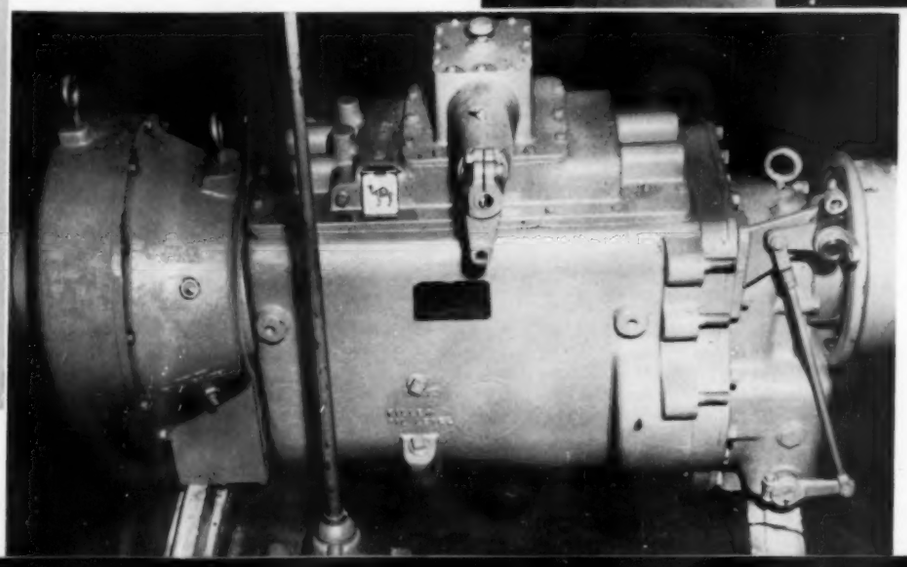
1. The 6:1 torque multiplication.

2. Automatic downhill braking—the three stage converter with over-running clutch has inherent braking when the vehicle drives from the rear axle back through the power train.

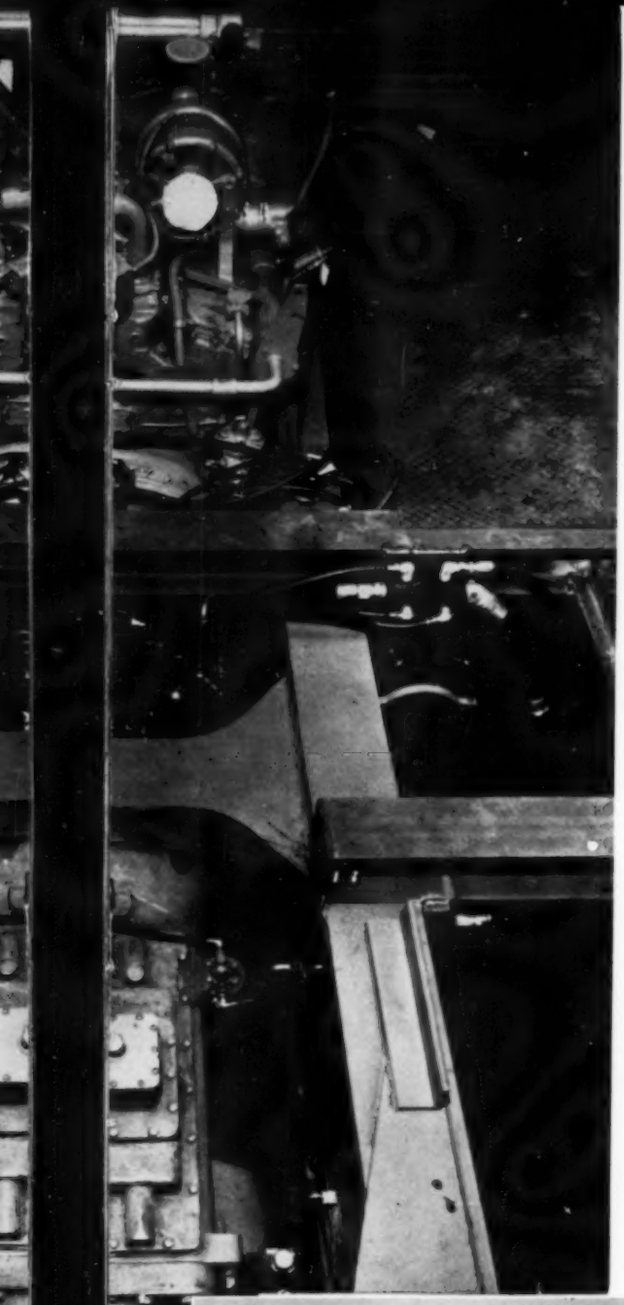
3. The necessity for gear shifting is greatly decreased. Innumerable ratios made possible by three-stage converters makes it possible on many operations to start and complete haul without a change of gears.

The KW-Dart model GU-1097 transmission is built for the truck manufacturer by Cotta in its Rockford, Ill. works. Its design incorporates a





At left is the gear train for the GU-1097 transmission Cotta builds for KW-Dart. The transmission, shown below, has four speeds forward and one reverse. Mounted on the front is the Lipe-Rollway two-plate clutch with air cylinder release.



self-contained amidship arrangement independent of the diesel engine and torque converter. Transmission includes a driving flywheel and two-plate 17 in. Lipe-Rollway spring-loaded clutch with air cylinder clutch release. It is of the constant mesh type with shifting accomplished with positive gear tooth clutches. It has four speeds forward—two reduced speeds, direct, and overspeed —and reverse. Ratios are as follows: 1st speed—2.32:1; 2nd speed—1.52:1; 3rd speed—1.00:1; overspeed—.76:1; and reverse—2.42:1.

In addition to inclusion of an air-actuated countershaft inertia brake, the transmission also has a built-in heavy-duty power takeoff with shaft extending from the rear of transmission. Rating of the PTO is 100 hp. The transmission, as illustrated, is mounted on a large trunnion on the front side of the clutch assembly and two fixed mounts on the rear, one on each side. In the design of the transmission, special emphasis was given to bearing type, capacity and locations. Spherical roller bearings are used at all points of severe loads for maximum thrust and radial capacity. Tapered Timken bearings are located under all heavily loaded speed change gears, and the ball bearings under higher relative speeds and lighter loaded reverse and idler gears. To hold shaft deflection to a minimum—the cause of most failures in a transmission of this type and capacity—a center wall was located in the middle of the case to provide for a center mainshaft and countershaft roller assembly. To maintain accurate alignment, all case bores are machined by Cotta at one time. All sections of the main case are made of ductile iron, a high nickel iron alloy for desired strength and ductility.

Consistent with the demand for larger payload vehicles, KW-Dart designs most of its trucks "oversize" to begin with and thus is able to keep pace with or one step ahead of the industry's requirements. Company engineers believe that the trend for higher off-highway truck speeds has now reversed itself except in the case of tractor-trailers for the coal fields. The move back, with 30 mph now about tops for dump trucks, is primarily the result of higher costs encountered by the operators—particularly in the area of tire replacement and maintenance.

In the transition from smaller vehicles, many changes other than in torque converters and transmissions have taken place such as in frames, axles, drive shafts, radiators, etc. For the most part, Dart now builds most of its own planetary axles. Usually single planetaries are used on all trucks up to 40 tons, and then tandem units above that capacity on both the end dump trucks and the end dump tractor-trailers.

Dart's new model 55T (55-ton end dump) with tandem planetary axles and powered by 600 hp Cummins VT-12 turbocharged diesel.

Here is the power train used on the Dart 55 and 70 ton trucks and tractor-trailers. Engine is the 600 hp Cummins which drives through a flywheel mounted Twin Disc three-stage torque converter to GU-1097 four-speed transmission. Prop shafts are Dana-Spicer.

Here is the large 100-ton Dart 95-EDT using a Kenworth OTR tractor and the original Dart truck built in 1903 for size comparison purposes. The original truck was powered by a 15 hp engine, and the 95EDT by a 700 hp Cummins VT-12-700.

CENTER FOR PISTON RING RESEARCH

By BRUCE W. WADMAN

SEALED Power Corporation has recently moved into a brand new research center in their Muskegon, Michigan plant. I had a chance to go through this facility in late June and was impressed with its many excellent features, as well as the scope and pace of piston ring and cylinder liner development programs for diesels and natural gas engines.

The new facility covers 42,000 sq. ft. and represents over a million dollars in investment. In this research and engineering complex activities are centered around basic research, metallurgical development and quality control, design engineering, and application engineering. There is a full range of laboratory equipment to test, evaluate and develop products and production processes.

The dynamometer test laboratory is particularly interesting and complete. Eight modern dynamometer test stands are available in a range from 150 hp to 600 hp for engine and transmission work. Each is installed in a 20 x 30 foot cell with its own heating and ventilating system. Fuels and exhaust are carried in trenches underground. Specially designed cells are also available for compressors and other specialized development and testing. When I visited the facility, an Allis Chalmers 21000 turbocharged diesel and the new 188 cu. in. Case diesel were being operated in the test cells to evaluate piston ring performance.

In piston ring development, Don M. Hesling, Vice President of Research and Engineering at Sealed Power, told us that a big part of their research effort is being aimed at the high output diesel and natural gas engine. There is much work being done at Sealed Power on new materials for higher temperatures and pressures in compression rings for these engines. As we move continually into higher bmep, turbocharged engines, the problem of blowby and piston ring-cylinder wall clearances becomes more important. The development of ring materials that will require little or no lubrication in the compression ring can be of significance in achieving the best operation and performance in these modern engines.

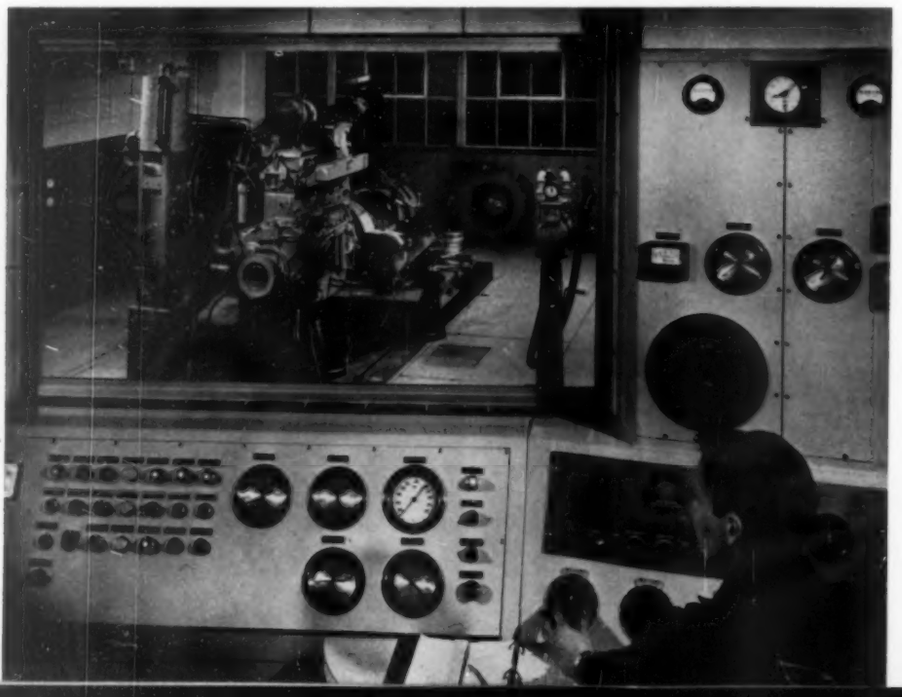
Materials like teflon, with a low coefficient of friction, are being developed as possible ring combinations; in fact, Sealed Power has had rings of this type operating successfully for several years in moderate output stationary gas engines. However, higher temperatures and pressures must be met in the future and continued development work is being done on materials for self-lubricated piston rings.

Surface coatings are also being developed for high output engine piston rings, and a useful research technique of accurately measuring the temperature of the piston ring wearing surface in relation to the main body of the ring is proving of real value in analyzing wear problems, surface coatings and surface finishes.

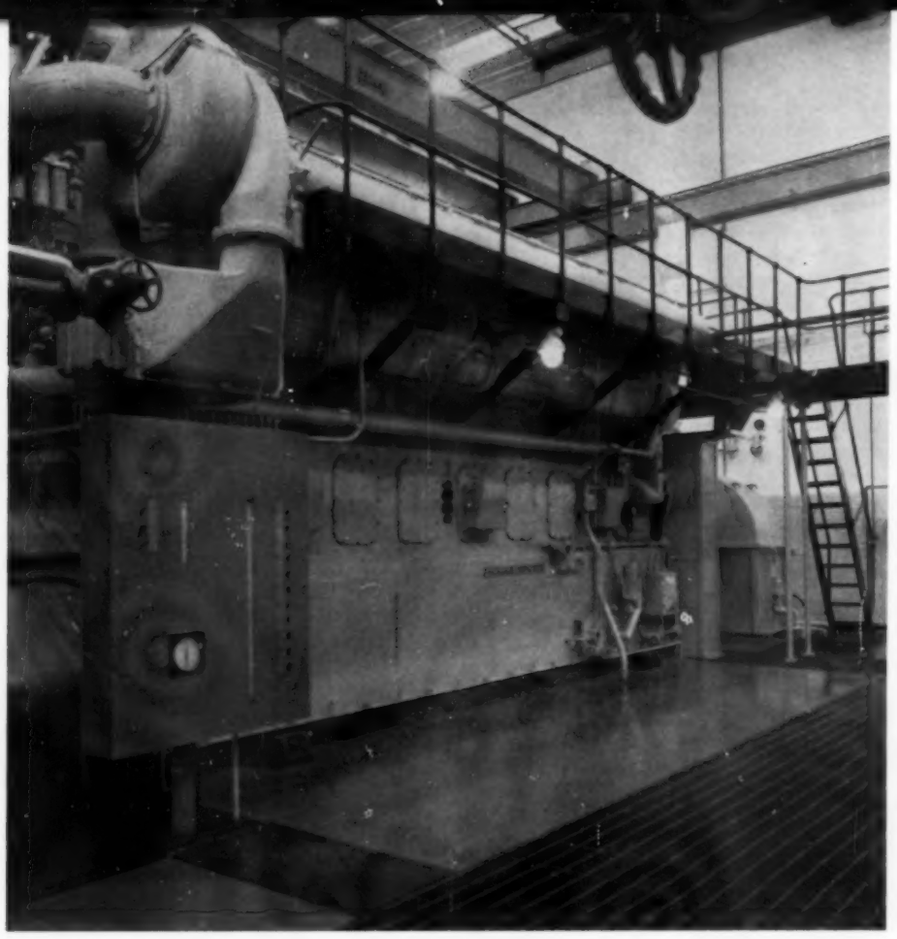
Corrosion resistant surface coatings and high strength irons for piston ring application in larger engines utilizing lower grade fuels are being developed in the piston ring industry. Sealed Power is doing intensive work in this area, particularly with chrome plated ductile iron compression rings in locomotive diesels to assure desired engine life where lower grade fuels are being used.

Good research and development people and facilities like these at Sealed Power are vital in the fast moving diesel and natural gas engine industry today, where better component parts must be continually developed to keep pace with the ever increasing performance and efficiency of our new and improved engines.

Sealed Power research center covers 42,000 sq. ft., represents investment of over one million dollars. This is main entrance to new facility.



Dynamometer test lab is equipped with eight units for testing engines to 600 hp. Here Allis-Chalmers model 21000 engine is on test stand.



Side view of one of the two 3500-hp Cooper-Bessemer engines powering each of the stations now in operation. Station flooring is largely composed of steel grilling, except for concreted work space abutting engine foundation.

and centrifugal compressor shaft. The compressors are designed to accommodate a wide range of sizes of impeller assemblies within the case. Cooper-Bessemer has developed a unique method of strengthening the impeller called "scalloping." "Scalloping" is a process in which a portion of the outer periphery between the blades of the impeller is machined off, making the structure more rigid without impairing aerodynamic performance. A finned type air cooling unit carries separate coil banks for engine jacket water, lube oil, and gear case oil. A similar, but smaller, unit maintains desired water and lubricant temperatures for the station's auxiliary plant, which has two Ingersoll-Rand gas engines driving Westinghouse generators. Either unit can carry the entire auxiliary power load of the station.

Since the stations are unattended, except for yard and maintenance men during the day shift for five days of the week, the automatic controls were designed and installed to achieve two results: to operate reliably, and to reduce operating costs. A dispatcher at the headquarters office at Roswell can dispatch the system—main line and supply laterals. To attain this, all controlled points are inherently able to control themselves in the event

Elton Sterrett Reports on . . .

TRANSWESTERN'S AUTOMATED 30 IN. LINE

OLD-TIME pipeliners would panic at the suggestion of leaving an internal combustion engine driven compressor station unattended for even a few minutes, but the newest of the big trunklines, Transwestern Pipeline Co., with 645 mi. of 30 in. natural gas main line between Roswell, N. M., and Needles, Calif., now has four stations—ultimately to become nine—with only a dispatcher sitting in the office at Roswell to know of and control all line and engine operating conditions. A fifth station, on the 24 in. West Texas lateral line is similarly controlled.

Each station is powered by two LSV-16 Cooper-Bessemer 4 cycle, spark ignition, turbocharged 16 cylinder natural gas engines, with a nameplate rating of 3500 hp when operating at 327 rpm and a maximum capability of 5000 hp at 360 rpm. Each engine is connected, through a Western double reduction gear, to a Cooper-Bessemer single-stage centrifugal compressor. The 16.8:1 ratio gearing consists of a two-stage, double helical, articulated unit, the output shaft normally operated at 5500 rpm. A damped spring-type coupling connects engine shaft and speed increaser low-speed shaft, and a high-speed coupling—extending through the engine room wall, connects gear box

of failure or malfunction of the communicating or metering circuits. Should such a condition occur, the unit will continue to operate under the last set of instructions sent it until the fault is corrected or operating conditions change sufficiently to trigger an alarm.

The dispatcher's control panel and, in background, indicating panels for each of the stations now in operation. By digital settings on central section of panel any change in operation may be instigated.

Safe operation of an automatic compressor station requires monitoring of all functions. At Transwestern safety devices are grouped in three classes: alarm, shutdown restart, and shutdown lockout. Covered are not only engine controls, but also all other functions in the station. Engine functions are completely interlocked to protect the station and system under almost any combination of conditions. The engine panel is designed for complete sequence startup, continuous operation, and sequence shutdown. The sequence startup and shutdown systems are interlocked so a malfunction will result in an engine shutdown, with event and cause displayed on an annunciator panel for that particular engine in the station auxiliary engine room. Since only the initiating cause is important, only the initial trouble is indicated on the board.

Under the three classifications of control the first, that of alarm, apprises the dispatcher of a condition which can be corrected by adjustment of line or engine conditions which are of momentary duration. A second condition, that of shutdown restart, also leaves the subsequent operation to the discretion of the dispatcher. The third, that of shutdown lockout, requires clearance at the station of the shutdown cause before the dispatcher can resume control of the engine or station. Under the last classification fall such functions as vibration exceeding the previously determined set limits in engine, compressor, reduction gear, gas piping, or fan; engine oil pressure fluctuation; low pressure in either turbo oil or gear oil; and high pressure within the engine crankcase. Functions which allow a dispatcher to restart a unit include high pressures in engine or gear oil, or in discharge gas; high temperatures in engine oil, jacket water, starting air, gear oil, compressor case, or compressor thrust bearing; high or low levels in seal oil accumulation tank or seal oil tank; high engine oil level; engine overspeed; and engine detonation.

Safety devices continually monitored are not those which initially would result in engine shutdown, but which would lead to serious malfunction if left uncorrected. On these, station supervisory or maintenance personnel would usually have sufficient time to reach the station and make the necessary adjustments before a shutdown condition has developed. Among those points continually monitored are high seal oil differential pressure; seal oil warning level; low level in engine or gear oil, jacket water surge tank or oil cooler water surge tank. Should any phase of automatic startup sequence continue past a predetermined time, a timing device monitoring it will take over and the unit will be shut down.

All automatic sequencing is either direct current or pneumatically actuated. In the event of generator failure, the electrical portion of the system is designed to initiate operation of an emergency generator to supply current to the control equipment as before, with no interruption in the functioning of the compressor or its engine drive. Should failure of electrical power also involve the emergency generator, stand-by batteries will automatically take over the load, at least eight hours of operation being obtainable from the storage battery set.

Compressor equipment for control and starting air includes a pair of Ingersoll-Rand reciprocating compressors, both for normal drive with electric motors deriving power from the station generating set, but one also equipped with an internal combustion engine drive which can be put into service simply by shifting the V-belt drive from the electric motor pulley to the engine pulley.

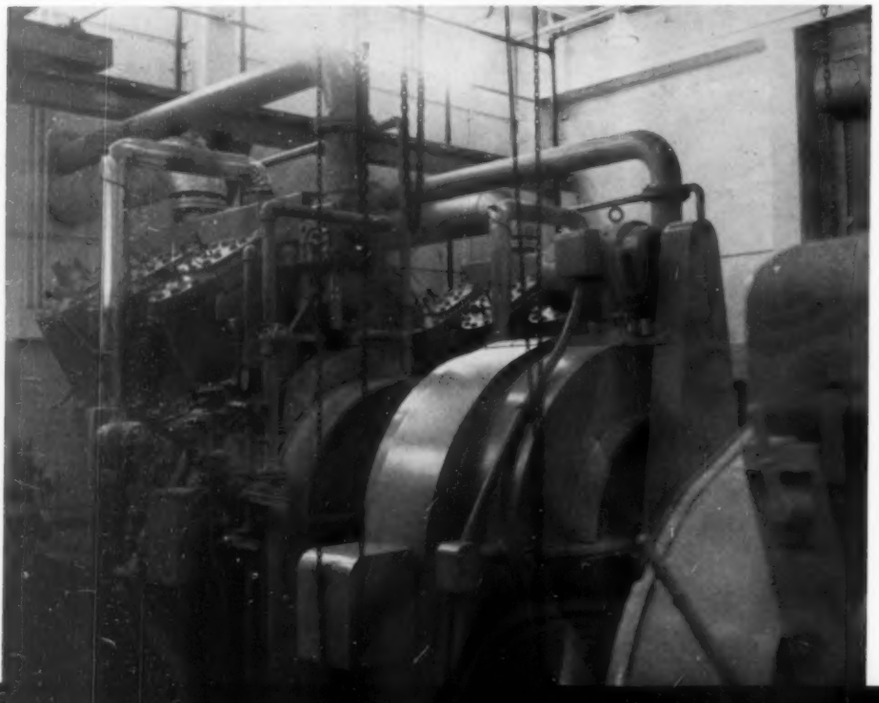
In the event of complete electric power failure, the equipment can be operated manually, using only the pneumatic control system for each engine.

The discharge pressure controller in each station is the key unit in determining the operation of the station and each engine unit therein. This is an electronic recorder-controller with a digital input set point servo-motor. It operates by recording the set point positional figure as determined by the dispatcher and set on his console, and then drives to that point. When the new set point is received, the instrument forwards that information to the dispatcher, again in digital form. The controller senses deviations in the actual discharge pressure from the set point and sends out a pneumatic signal to one engine—or both if two are in operation—to raise or lower the engine rpm, and thus brings the pressure within the scope of the set point. Station volume control is secured by varying the engine speed.

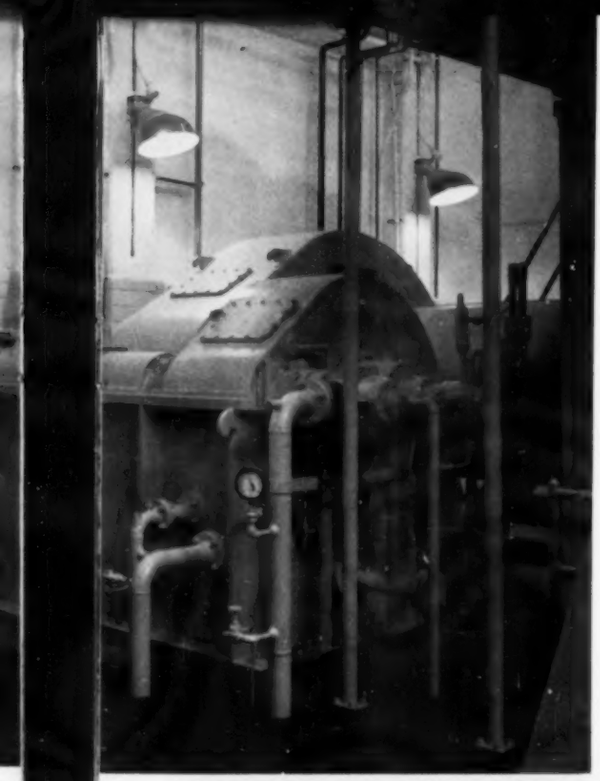
Present normal operation of the system involves use of both engines to obtain the required discharge pressure, with the gas stream passing through each compressor in turn and then again into the main line. Station piping is such that either engine-compressor unit may be used alone, check valves preventing back-pressure being developed in the unit which is down. A station by-pass permits the entire flow to be diverted around the two units if desired.

The main line, traversing most of New Mexico and all of Arizona lies in a section of the United States where only slight rainfall is experienced, and the stations are therefore exposed to severe dust and sandstorm contamination. Oil-bath cleaners purify the combustion air—being located high to avoid heavy dust concentration near ground level—after which the air passes through the pulsation dampener into the supercharger, is cooled, and passes into the intake manifold of the engine.

A step-down hydraulic drive, mounted on each engine shaft at the end opposite the gear box from the gas compressor drive, is thermostatically controlled to give the desired speed through a



One of the Ingersoll-Rand PSVG engines, driving a Westinghouse generator in the auxiliary room. These units, like the compressor drive engines, are remotely controlled and fully protected.



The Western Gear speed increaser in its all-welded steel case carries double step-up gears, with high-speed shaft to the left of the low-speed shaft connected to the engine with hydraulic coupling.

mitre gear to the vertical shaft on which is mounted the fan which provides draft in the finned coil units for jacket water and lubricant cooling.

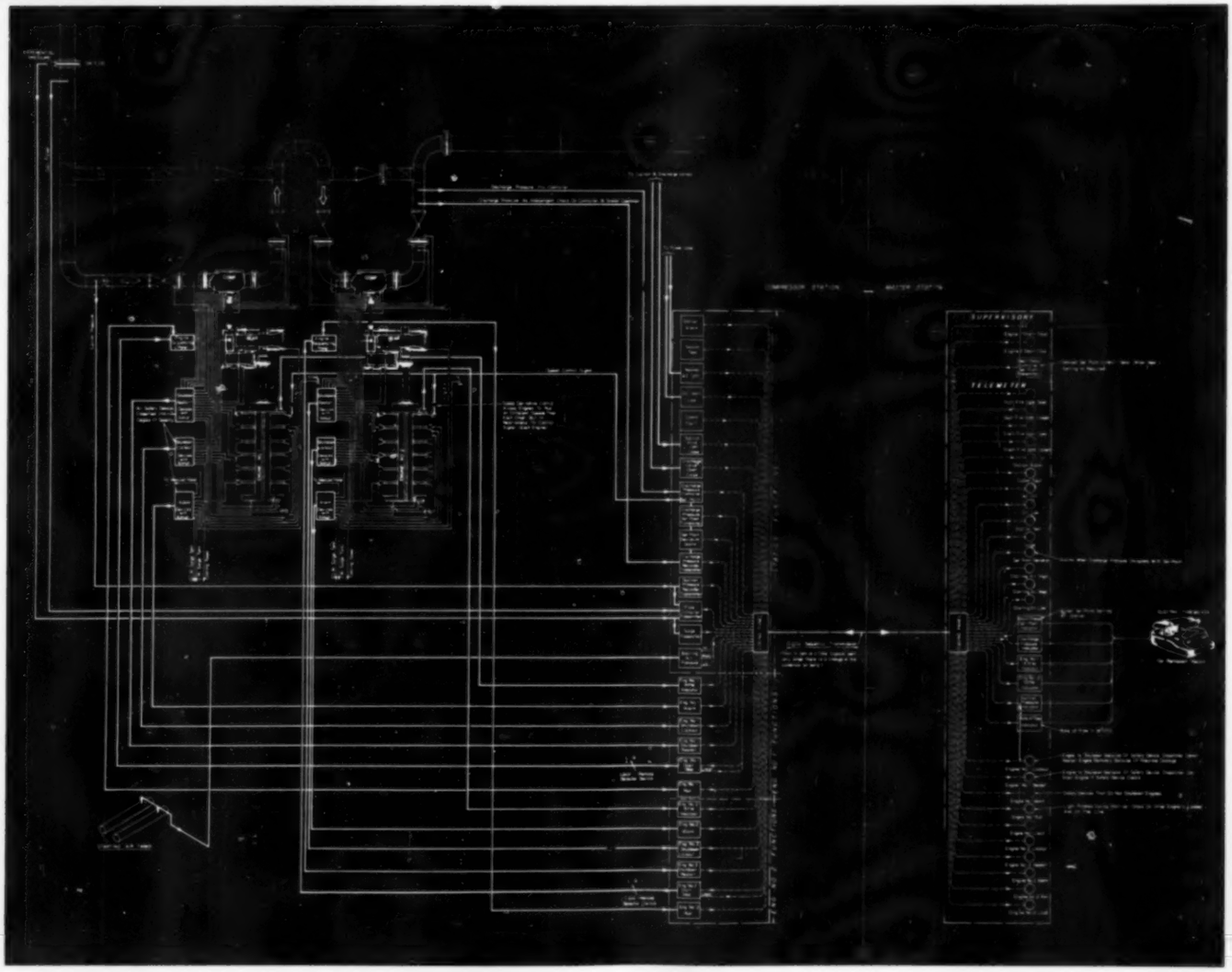
A 0-15 cps supervisory control system connects all stations and the metering station at Needles with the dispatcher's office. Each function is received or ordered digitally, coded to a pulse system for transmission, and then decoded again to digital units for operation of the various controls or for reproduction on the panels in the dispatcher's office at Roswell.

Designed to operate at a maximum pressure of 1008 psi in the discharge manifold at each station, with station spacing as at present constituted, two engine-compressor units are required to maintain the desired throughput. As deliveries mount, additional engines and compressors can be added in existing stations and the intermediate stations already incorporated in the master plan can be installed until an ultimate of nine main line stations will power the system, after which further expansion will be obtained by means of looping the existing 30 in. pipeline.

Principal Equipment

Main engines, compressors	Cooper-Bessemer
Speed increasers	Western Gear
Auxiliary engines	Ingersoll-Rand
Generators	Westinghouse
Air intake filters	American
Lube oil filters	Nugent
Seal oil strainers	Elliott
Aux. engine cooling unit	Young
Mufflers, snubbers	Burgess-Manning
Vibration switches	Fulton-Sylphon
Function monitors	Minneapolis-Honeywell
Pyrometers	Alnor

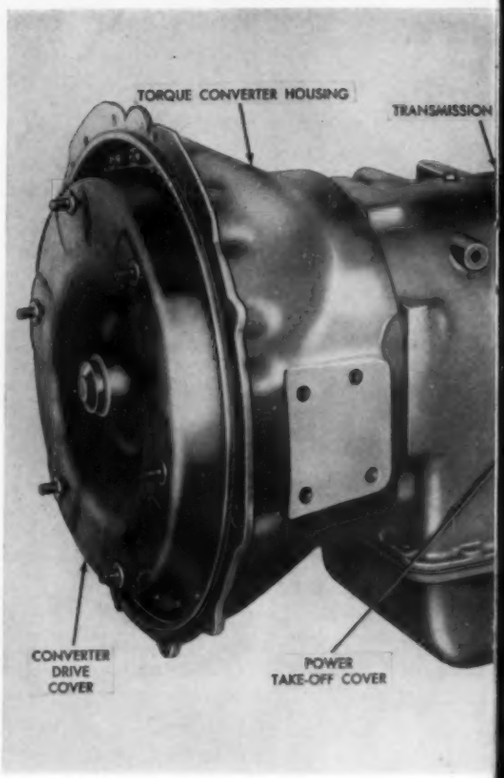
Schematic diagram of remote control setup for Transwestern compressor station. All engine and compressor functions are monitored by the system. Warning and shutdown controls safeguard operation.



AUTOMATIC TRANSMISSION FOR DIESELIZED VEHICLES

Allison Adapts Truck Units To Meet Requirements Of Diesel Service; Application Involved Changes In Converter and Clutch Capacity, Controls To Match Diesel Operating Speed

By DOUGLAS SHEARING



WITH use of diesels gaining momentum in stop-and-go trucking as well as in medium to light duty over-the-road vehicles, the Allison Division of GMC has adapted its fully automatic truck transmission to meet requirements for these types of service.

This Allison transmission was among the first full automatics offered to the trucker but was originally designed and matched to the gasoline engine. It features a torque converter with automatic lockup clutch, a 6-speed planetary gear train and hydraulic retarder. The units demonstrated ability to turn in reliable performance for the commercial truck operator while offering a number of advantages over conventional transmissions. These included, among others, less trip time, driver recruitment and training expense; elimination of engine clutch, lugging and shock load damage; and extra benefits of high starting torque and converter driven power takeoff. These points, along with increased payloads, longer engine life, greater safety and reduced maintenance helped increase acceptance of automatics and led inevitably to application to diesels where the same list of advantages are expected.

Adapting the automatic transmission for diesel applications involved, primarily, changes in three major areas: converter capacity, clutch capacity, and automatic controls.

Speed is one of the important considerations when studying adaptation of automatic transmission to an engine and the torque rating is also equally important. The combination of torque-speed relationship determines what capacity converter will be needed and whether the output of the engine-converter match is within the specified range of the transmission. To adapt to the diesel engine, a converter with greater capacity than that used with the automatic for gasoline engine applications was required.

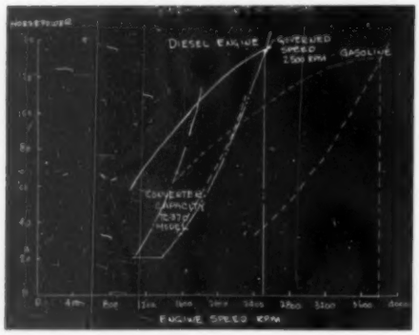
Next step in adapting the transmission for diesel applications involved a check of capacity of the two direct acting rotating clutches. Since holding capacity of these clutches depends on engine speed, it was necessary to investigate the effect lower diesel engine speeds would have on their ability to hold torque. The checks indicated that only the splitter clutch needed increased capacity. This was accomplished by adding a clutch plate and modifying the return spring to give increased holding capacity.

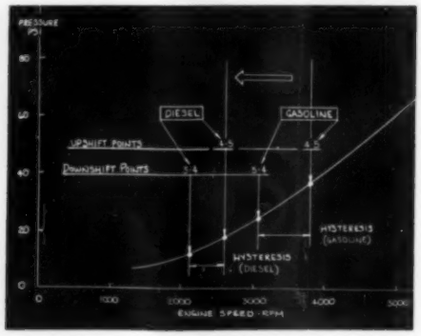
In the realm of automatic controls, the effect of the speed of the diesel had to be determined. Mainly the shift points in each range needed to be modified because of the relatively lower operating speed of the diesel. Scheduling of shifts is accomplished by fluid velocity governors which sense the output speed of the transmission. Changing of shift points was accomplished by making modifications of several valve body components and the hysterisis range was decreased so it would be compatible with the smaller operating range of the diesel by modifying the shift valve. (Fig. 2.)

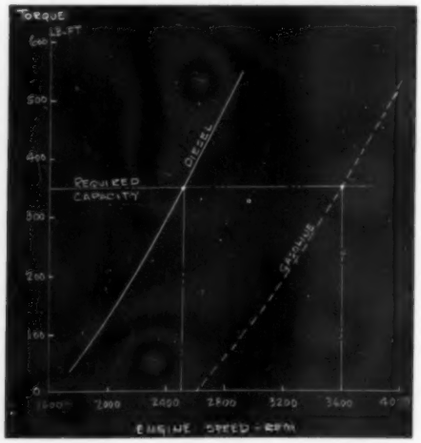
The transmission, as stated above, consists basically of the torque converter with lockup clutch in series with a six-speed, planetary gear train plus an integral hydraulic retarder. Four forward speed ranges are provided and automatic shifts within each range are controlled by the throttle position and vehicle speed.

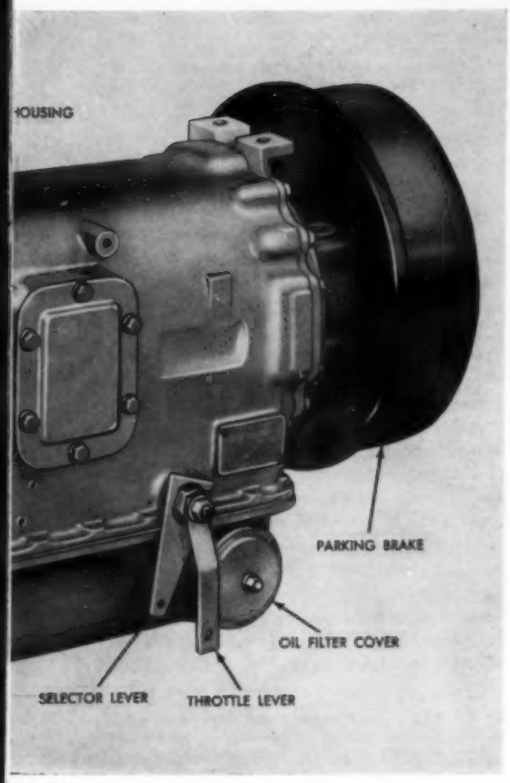
The series arrangement of the four planetaries allows one of them to become a "splitter" for the others. The splitter is located ahead of the basic three-speed gear package composed of simple planetary gear sets. By using a two-speed splitter gear set in combination with the basic group, six forward speeds are obtained. In other words, each basic gear can be split by shifting the "splitter" gear back and forth from low to high. The six

Figure 1, left, shows how converter of greater capacity was matched to diesel engine, which operates at lower speed than gasoline unit. Figure 2, center, illustrates governor pressure curve and changes required in shift points. Figure 3, right, shows increased capacity of splitter clutch need for diesel transmission.









Allison fully automatic transmission for diesel-powered trucks is six speed unit with hydraulic retarder and optional power takeoff.

speed pattern is shown below along with optional converter ratios:

Converter ratio	2.50:1	2.80:1	3.50:1
Gear ratios			
6th	1.00:1		
5th	1.39:1	1.39	
4th	1.94:1	1.39	
3rd	2.69:1	1.39	Ratio
2nd	3.81:1	1.39	Steps
1st	5.29:1	1.39	
Total ratio	13.21:1	14.80:1	18.50:1

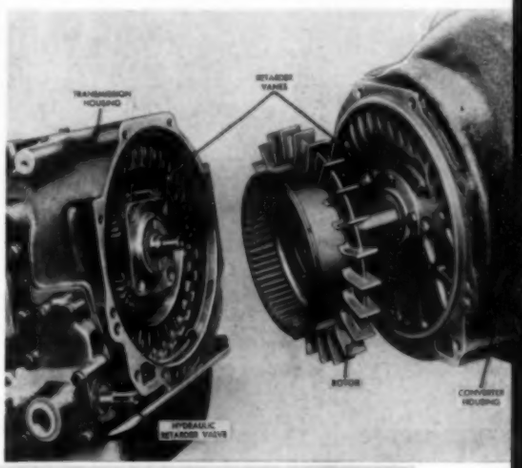
The four operating ranges include: 1-2 creeper, 3-4, 3-5, and normal driving range 3-6, all selected by the driver. In 3-6 range designed for most highway driving situations, it provides automatic operation from converter, through third, fourth, fifth, and sixth gears. The 3-5 or 3-4 range provides automatic operation from converter through third, fourth, and fifth gears; or from converter through third and fourth gears respectively, to maintain torque reserve needed for flexible, responsive action in congested traffic and to increase effectiveness of the retarder. The 1-2 creeper range provides automatic operation from the converter through first and second gears giving the driver breakaway torque and load control needed in off-highway operation or steep grades.

To get underway in each forward range, the transmission starts in converter. As the vehicle picks up speed and less torque multiplication is needed, the converter locks up automatically and remains locked through the shift sequence, except for its momentary action at the shift points. However, the driver still retains optional control over the automatic shifts by a throttle detent resistance to obtain the optimum gear ratio for maximum performance and vehicle control in unusual situations.

In highway truck operation the ability to maintain high average road speed depends not only on speed that the truck can ascend a hill but also how fast it descends the other side—with safety. To provide for this portion of a truck's trip, the Allison transmission is equipped with an integral retarder located between the converter and planetary gear train. When a brake valve is operated, oil circulates through the cavity absorbing energy in the form of heat, passes back through the retarder contol valve body at a controlled rate and is directed to an external oil cooler. With diesel operation, the retarder is adequate to relieve the service brakes when the transmission is functioning in low range. In the other ranges, it assists the service brakes to a much lesser degree than that obtained with low range operation.

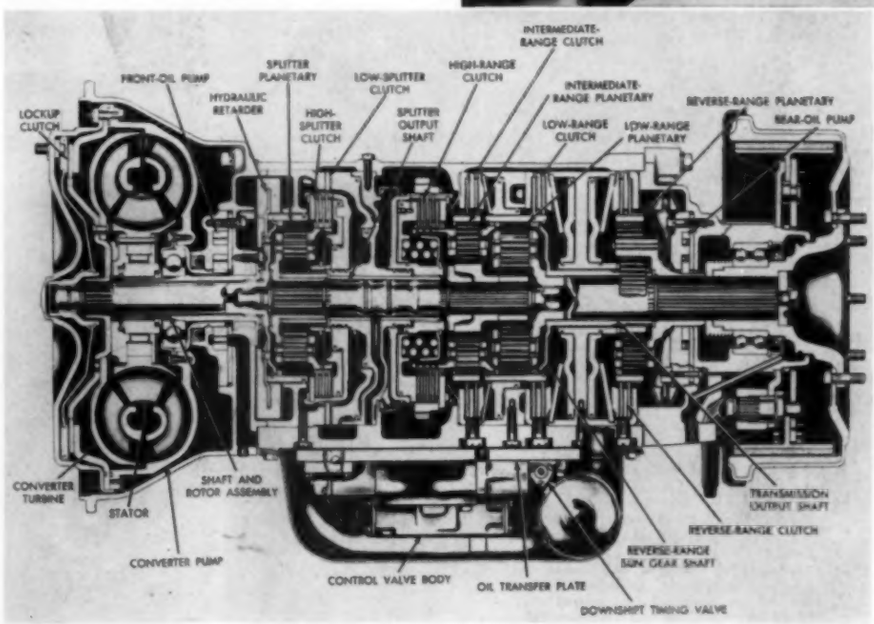
The transmission is equipped with two SAE, six-bolt power take-off mounting openings—one on the right, the other on the left side of the transmission. Either mounting provides a converter-driven pto which provide simple control, smooth application of power. When engaged, the pto drive has the same torque converter characteristics as the transmission has for vehicle propulsion. When simultaneous operation of the vehicle and the pto is required, such as spreading gravel, the converter automatically balances the load requirement for the combined operation.

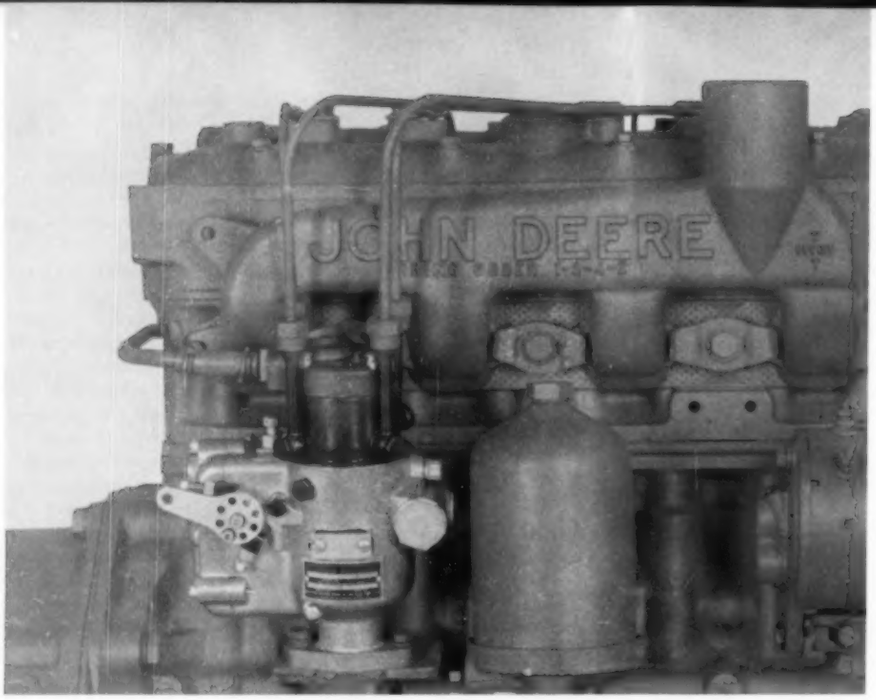
Said R. M. Schaefer, manager of transmission engineering for the Allison Division: "The move toward a more general use of automatic transmissions is quite evident as shown by the increased usage with gasoline engines. It would be safe to forecast that in another year or so all major truck manufacturers will have similar transmissions available in combination with light diesels as this engine expands into the multi-stop type of truck application." Schaefer declared that the automatic transmission for diesels promises to be particularly effective in the new "powered combinations" such as the Wolfwagon units. (See D&GEP, August, 1961.) These self-powered trucks can be coupled in tandem for over-the-road travel and later uncoupled for use as individual delivery units at their destinations. In tandem, Schaefer said, these "highway trains" will be able to utilize the power of all the trucks through the synchronizing feature of the torque converter which is integral with the automatic transmission.



Hydraulic retarder is integral part of automatic transmission and is located between converter and plantary gear train.

Cutaway drawing of Allison transmission shows locations of converter, retarder, gear train etc.





Four cylinder John Deere diesel engine mounts Roosa Master fuel pump vertically. Mounting flexibility allowed pump to be driven from same place as distributor on gasoline version of this engine.

PUMP PRODUCTION RECORD IS STORY OF SIMPLICITY

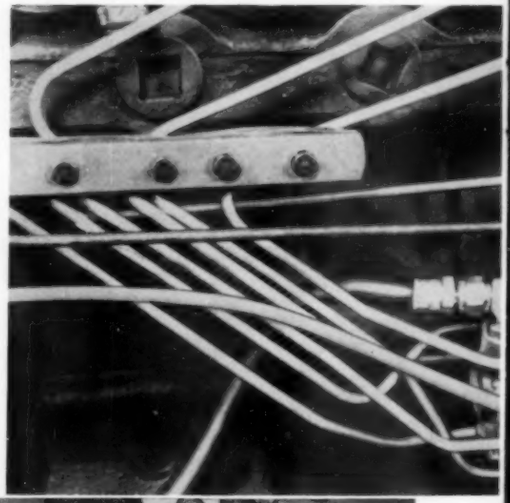
TWO words used extensively in our industry today are . . . simple and efficient. They more than characterize the diesel engine—they are reflected in a product in which years of research and testing, and untold dollars have been invested. Manifold are the developments that have contributed to the widespread use of the diesel and the constantly expanding application of this form of power. Among these developments, the work accomplished in fuel injection systems has been exceptionally important.

As an example, back in the November, 1952 issue of this magazine, we published an article on the then-new Roosa Master fuel injection pump —a distributor type pump with inlet metering and integral governor built by the Hartford Machine Screw Co. What has happened in the nine years is notable, for on May 26 the 250,000th Roosa Master pump was produced! Almost more important, the largest part of this production has been achieved in the last four years. What have been the factors that contributed to this success? Market awareness coupled with designed-in product simplicity and versatility appear to be the answer.

Of the above factors, simplicity is the most striking feature of the Roosa Master pump, yet this too is an essential element in its application versatility. For instance, the model DB Roosa Master pump has a common housing regardless of the number of cylinders, permitting two or three-hole flange mounting in any position including vertical. In addition, basically the same pump will serve two and four-cycle engines of 2, 3, 4, 6 and 8 cylinders with displacements from 25 to 100 cu. in/cylinder.

From the model A pump, the first production unit built in 1952 for the Hercules DJX and DOO diesels, the pump has undergone a number of changes in the interest of compactness, parts simplification and standardization, and consequent lower cost. In addition, new accessories to increase its operating flexibility such as automatic advance, starting and overspeed governor, electric shut-off and variable speed droop adjustment have been developed. In essence, however, the pump has not varied from the original design concept of inlet metering as applied to a distributor

The Roosa Master model DB pump can be mounted vertically or horizontally, as on this International engine to meet builder requirements.



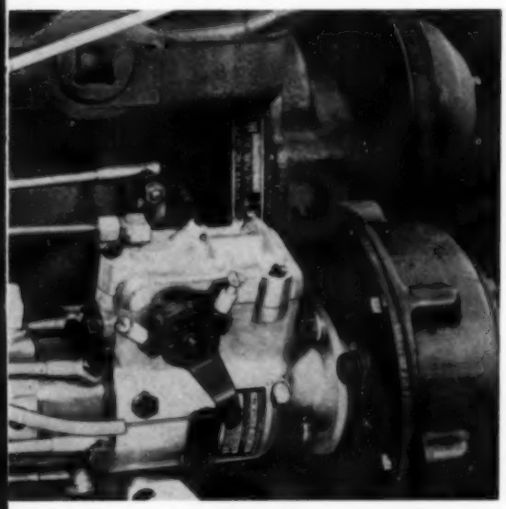
Responsible for all phases of the Roosa Master service program is Jim Britton, shown here conducting one of a continuing series of service clinics.

Here are three key members of the Fuel Injection Division of HMS that have played chief roles in the success of the Roosa Master pump. Vernon Roosa, director of research, from whom the pump takes its name. Ernest "Red" Willson, engineering manager, who teamed with Roosa in pump development, and Jim Ford, general manager, who organized the HMS sales and service organization.

system. The A pump was followed by the model D, and now the present DB pump which has a total of about 70 parts, only three of which are main rotating components—the drive shaft, distributor rotor which contains the pump plungers, and the transfer pump. These are all arranged compactly on a common axis.

The comments of James Ford, General Manager of the Fuel Injection Division of HMS perhaps best describe why the Roosa Master pump has been successful—"We firmly believe that smaller vehicles and tractors represent the greatest market for diesels . . . and feel that it is our responsibility to come up with even less costly fuel injection systems of novel design to make diesels even more competitive with other types of power." Striking evidence of what has been accomplished with this market attitude is the development of several small diesels using the Roosa Master pump—excellent examples being John Deere's new 40 to 80 hp tractor diesels; J. I. Case's new G188D Rock Island diesel; and International Harvester's D-236, D-282 and D-301. In addition to these manufacturers, Roosa Master pumps are also on diesels produced by Allis-Chalmers; Continental Motors; Ford Motor, Tractor & Implement Div.; Harnischfeger Highway Products, Motec Industries; Schramm; Waukesha; and Witte.

Another significant part of the overall Roosa Master pump picture has been the license agree-



ment in 1953 between Hartford Machine Screw and C.A.V. Ltd., major fuel injection equipment builder in Great Britain, for exclusive manufacture of the pump in England and the Commonwealth countries. C.A.V. saw in the Roosa Master pump a unit ideally suited for the then burgeoning production of small agricultural, automotive, and marine diesels and has tailored production of their DPA pump at their Rochester, England, plant to these operating requirements. Since the DPA pump was introduced in 1956, C.A.V. has produced 500,000 units—the second quarter million in the last 18 months and current production at the rate of nearly 250,000 pumps a year. Just this year, Roto Diesel of Paris, France was also licensed to produce and sell the Roosa Master pump in the European common market countries.

KEEPING A HARD WORKER COOL IS A TOUGH JOB

YA Yates-American Radiators AND HEAT EXCHANGERS are DOING THE JOB FOR GARDNER DENVER'S Revolutionary NEW ROTO SCREW COMPRESSOR

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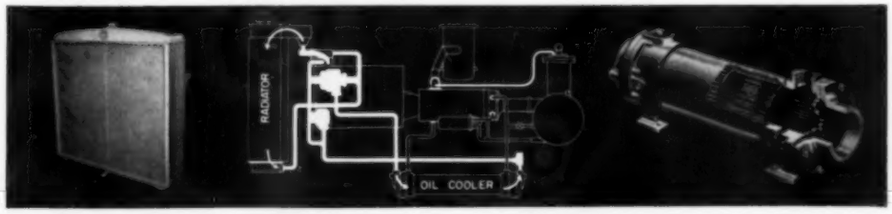


YATES-AMERICAN HEAT TRANSFER DIVISION 703 4TH ST., BELOIT, WISC.

NEW PRODUCTS HIGHLIGHT SAE EXHIBIT

OVER 80 manufacturers will exhibit at the SAE Heavy Duty Vehicle Meeting in Milwaukee September 11-14. Site of the Engineering Display is the Milwaukee Auditorium-Arena and on this and other pages in the magazine we focus attention on many of the new and established products that will be shown. Here in capsule form is a description of some of the exhibits that reached us prior to press time:

Purolator Products will feature a new two-stage dry-type air filter specially designed for diesel engines operating under heavy dust conditions. The new filter consists of two separate filtering elements telescoped within a single housing. Each element filters independently of the other thus offering double protection for the engine. Also on display are micronic paper, metal edge, wire cloth and porous metal filters.

Anchor Coupling Co. will feature Super-Spiral reinforced high pressure hydraulic hose assemblies. These assemblies are available with pressed-on "O" ring flanged head couplings Anchor will also exhibit its full line of pressed-on, reusable and clamp-type hose assemblies and fittings.

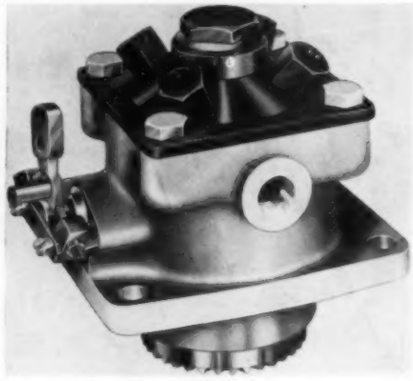
Hartford Machine Screw Co. will display several samples of its model "DB" Roosa Master fuel injection pump, including such accessories as automatic advance, electric shut-off, speed droop, and hydraulic throttle device. Other items on display will consist of: fuel filters with and without glass sediment bowl; samples of electric auxiliary fuel pumps having a capacity of 6 to 20 gals./hr., a hand primer pump; and a working model of the hydraulic throttle device.

The Twin Disc Clutch Co. exhibit will feature an oil-lubricated power take-off, two transmissions and some universal joints which represent some of the newest products manufactured by Twin Disc. The TD-44-400 series power-shift transmissions are four speed forward, four speed reverse design units with full power-shifting ability in all speeds. The TD-44-1100 series power-shift transmission offers four forward and four reverse speeds using three oil actuated, rapid engagement duplex clutches. This series is presently designed for use with engines having up to 225 hp at 2100 rpm or with converters capable of absorbing not over 560 lb. ft. of torque from the matched engine. The new model J series universal joints are available in three standard sizes. In capacity, they range from 4,250 to 12,700 lbs./ft. rated static torque. The new SP-211 power take-off is an oil lubricated unit for high speed applications.

Twin Disc "J" series universal joints range to 12,700 lbs./ft. rated torque.

The Harrison Radiator Div., General Motors Corp., will display heat exchanger equipment for temperature control problems. The background of their exhibit will depict, through use of translight panels, cutaway drawings and details of heat exchanger equipment and actual samples of heat exchangers for aviation, marine and industrial use will be on table display.

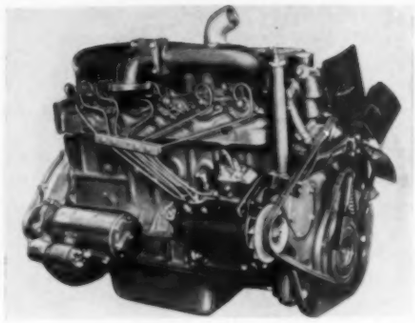
The American Bosch display will contain its complete line of commercial products, including: industrial magnetos; special service generators; voltage regulators; electric windshield wipers; small electric motors; Hydrotor hydraulic cranking systems; Ensign LP-gas carburetion equipment; and diesel fuel injection equipment. Featured new products will include—three new fuel injection pumps, the PSU, PSH, and PSJ types.



American Bosch type PSU multi-cylinder single plunger injection pump.

Along with engine models representative of its line of Series 71 and 53 diesels, Detroit Diesel Engine Div.'s exhibit will include a picture display showing a wide variety of manufacturers' equipment powered by the Division's "V" and "In-line" engines. Representing the "71" series is an activated cutaway model of a six-cylinder "V" engine. Series 53 engines are represented by a three-cylinder "in-line" model. This series was introduced by the Division early in 1959 and consists of four "in-line" and "V" models ranging from 33 to 195 hp. Picture display consists of approximately 30 photographic enlargements featuring equipment powered by GM diesels.

Six engines will be exhibited by Hercules Motors Corp. including its models CV4-180; GO-226-AH; G-339-H; DD-169-H; D-300; and D-420. The latter five engines are completely interchangeable units which feature high performance, low fuel consumption and minimum smoke characteristics. The D-420 series is Hercules six-cylinder Polydiesel—a 4¼ x 5 in. pre-cup engine with 426 cu. in. piston displacement.



International-Harvester D-301 diesel is naturally aspirated unit.

Featured in the International-Harvester exhibit will be the recently introduced D-301 diesel—a compact, lightweight engine for medium-duty truck application. It is naturally aspirated, has a piston displacement of 301 cu. in. and delivers 110 hp at 3,000 rpm. Characteristics of the diesel include high torque output at low speed, low fuel consumption and long operating life. It weighs 902 lbs., or 8.2 lbs./hp. In addition, International will show its V-345 engine in cutaway form.

The Young Radiator Co. exhibit, through the use of radiator and heat exchanger cutaway samples, will stress construction features and heavy-duty design. Numerous standard heat transfer surfaces illustrating fusion bonding, brazing, and welding techniques will be shown. Radiator tank sample with an oil cooler plus a selection of various standard top and bottom tanks make up an interesting special display. Other standard products on exhibit will include: a mono-weld radiator, a sheet metal radiator, a type OH oil cooling unit and several heat exchangers.

Imperial-Eastman will display its complete line of hoses, tubing, fittings, couplings and adapter unions, and swivel joints. Hytron hose made by Imperial-Eastman is a high pressure thermoplastic with a seamless polyamide inner core. Also highlighted at the exhibit will be high pressure spiral wound hose, a new reusable 4-bolt clamp coupling and Hi-Seal compression type tube fittings.

The Rockford Clutch Division of Borg Warner Corporation will feature its spring loaded 13 and 14 in. RT clutches plus the Rockford power shift clutch—a heavy duty unit with automatic torque modulation. This transmission clutch is designed to give full power, high speed shifts with smooth, fast engagement. Other divisions participating are: Borg & Beck; Marvel-Schebler Products; Warner Gear; and Mechanics Universal Joint.

Perfex Corporation's exhibit will be totally new and will focus attention on several new intercoolers and heat exchangers for high speed diesel application. Schematic drawings showing air flow through these units will be shown as will product views of the company's complete line of heat exchange products.

GAS TURBINE PROGRESS

A MONTHLY SUPPLEMENT TO DIESEL AND GAS ENGINE PROGRESS REPORTING ON NEW DEVELOPMENTS AND APPLICATIONS IN THE TURBINE POWER FIELD

Turbine-Powered Tractor Has Hydrostatic Transmission

Under the fiberglass skin of its newest research tractor, International Harvester Co. has paired a gas turbine engine with a hydrostatic transmission. Unveiled in July, the company believes this may be the first time the combination has ever been tried in a farm and utility tractor.

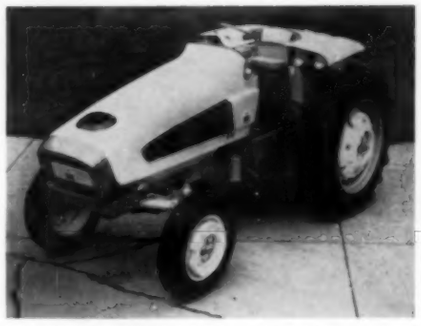
Called the HT-340, this concept of "things to come" in the tractor line has no gear shift lever, no throttle, no brake or clutch pedals, no transmission gears. It will operate on virtually any kind of liquid fuel. Forward and reverse speeds are infinitely variable, it starts readily at low temperatures and is notably free of vibration.

"We think the gas turbine may become the natural running mate to the type of hydrostatic transmission which our Engineering Research group demonstrated in a tractor last year," said A. E. W. Johnson, vice president of Engineering. "The turbine engine is capable of delivering horsepower roughly equal to its weight. And the hydrostatic drive provides infinitely variable speed control."

The gas turbine, an 80-horsepower, single-shaft Titan T62T, is a product of Solar Aircraft Co., Harvester's San Diego subsidiary. It is 21 in. long, less than 13 in. in diameter and weighs only 90 lbs. with reduction gearing. It was originally designed for aircraft propulsion (one-man helicopters, flying platforms), among other things.

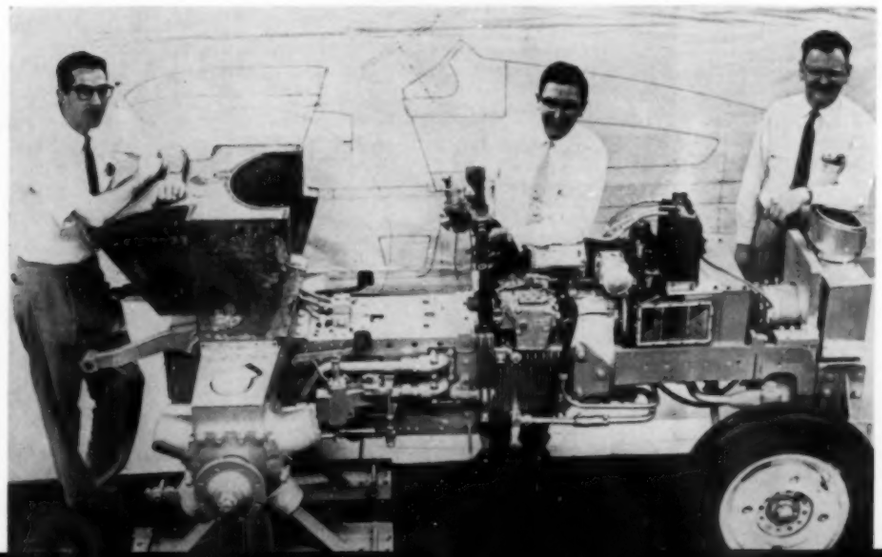
The HT-340 can, at present, use only about half of the turbine's rated horsepower since the transmission was designed to operate with a 40 hp piston engine. Gearing reduces speed of the turbine's output shaft to 2000 rpm. But in a ground vehicle, a constant-speed turbine is particularly well-matched with a hydrostatic transmission to provide speed variation.

"Our intent in developing this tractor," say C. H. Meile, chief engineer of IH Engineering Research, " is to continue our investigation of new types of power systems. This is one of the combinations that is both new and promising." The Solar Titan engine in the HT-340 has a single turbine that turns the output shaft directly, producing constant engine speed.

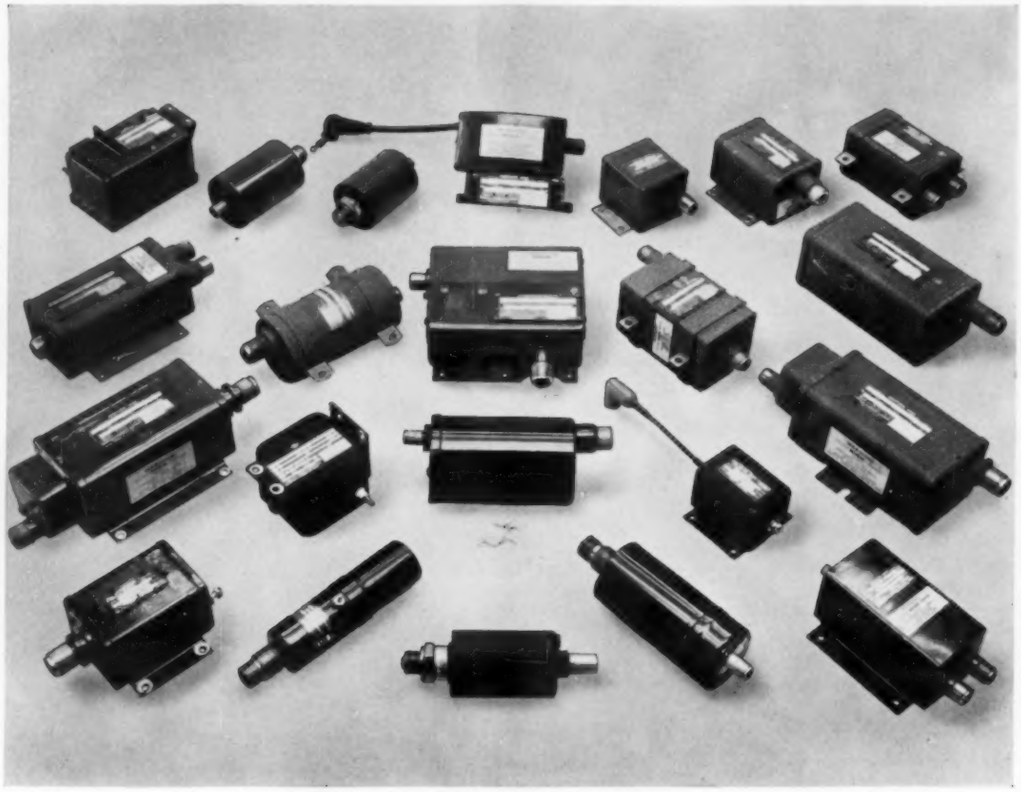


Tractor design trend toward increased power and more precise power control may make natural running mates of gas turbine and hydrostatic transmission in future. Turbine engine permitted radically new visual concept. Skin sections are molded fiberglass.

Profile view of Harvester's HT-340 tractor on assembly stand reveals what Company believes may be first pairing of gas turbine engine and hydrostatic transmission in a farm and utility tractor. Note rear-mounted fuel tank, front exhaust, air intake on side. IH Engineering Research personnel in picture are, from left: John R. Cromack, test engineer; Carl H. Meile, chief engineer; and Ralph E. Wallace, research engineer.



The Harvester research tractor adds to its gas turbine features the infinite variability of a hydrostatic transmission. Minus all the gears, shafts and splines of a conventional transmission, this system depends on oil at high pressure to transmit power by acting on the pistons of a radial hydraulic motor installed in each driving wheel. Thus the turbine engine's power operates the variable displacement pump which energizes the transmission. Except for steering, the operator is concerned with only one control—the transmission lever—to change forward and reverse speeds and to stop. The hydrostatic tractor has excellent torque characteristics and response to its transmission control is immediate and solid throughout its speed range (maximum: 11 mph). "We are certainly making no claims for the HT-340's fuel economy," Meile said. "At this point in our research program, we haven't even tried to improve it. Heat exchangers, or regenerators, to recover heat from exhaust for preheating intake air, would seem to be the answer. We are already working with regenerative cycle engines. That will be our next step."



BENDIX IGNITION EQUIPMENT

Tailored to specific gas turbine needs

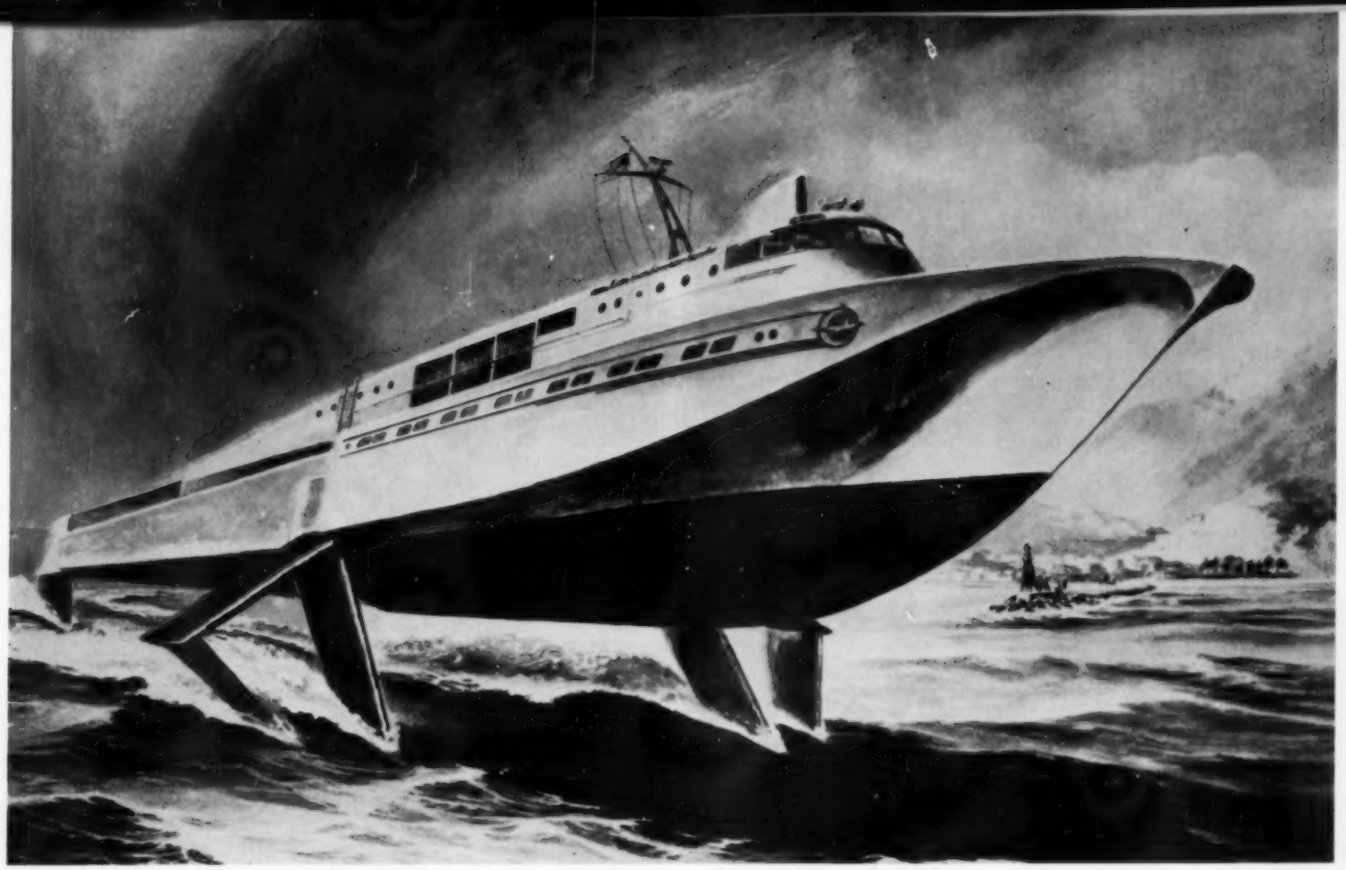
You see here some representative members of the large Bendix ignition equipment "family" developed to meet *exact* gas turbine engine requirements.

As specialists for many years in designing and producing ignition equipment of all kinds, the Scintilla Division of Bendix is able to "tailor-make" systems that unerringly combine the ignition characteristics best suited to a particular gas turbine engine.

To round out the ignition "package," we also produce a full range of igniter plugs, cables, electrical wiring harnesses, and electrical connectors.

For ignition equipment that assures full-time efficiency, call us.

Scintilla Division
SIDNEY, NEW YORK



New 104 ft. hydrofoil vessel nearing completion by Dynamic Developments Inc., will receive main propulsion power from 14,000 cont., hp GE gas turbine engine. Power for displacement operation will come from 750 hp GE turbine. Two AiResearch turbines will supply starting and auxiliary power.

GAS TURBINE DRIVE SYSTEMS FOR LARGEST HYDROFOIL CRAFT

Main Propulsion Power for Foilborne Operation on MARAD Craft Will Be Provided by GE Model 240 Gas Turbine Engine With GE Model 720 Unit for Displacement Operations, AiResearch Turbines Providing Starting, Auxiliary Power

CONSTRUCTION of the largest hydrofoil vessel ever built in the U. S. is nearing completion at Bethpage, N. Y., by Grumman Aircraft Engineering Corp. The 80 ton craft, with all power supplied by gas turbine engines, is designed for speeds up to 60 knots and is the first designed for operation in the open seas. Constructed by Dynamic Developments, an affiliate of Grumman, under a contract with the U. S. Maritime Administration, (MARAD), the vessel is a joint government-industry financed project. Launching is expected in late summer with sea trials to follow shortly. The vessel will be transported to the Long Island launching site in two sections, hull and superstructure.

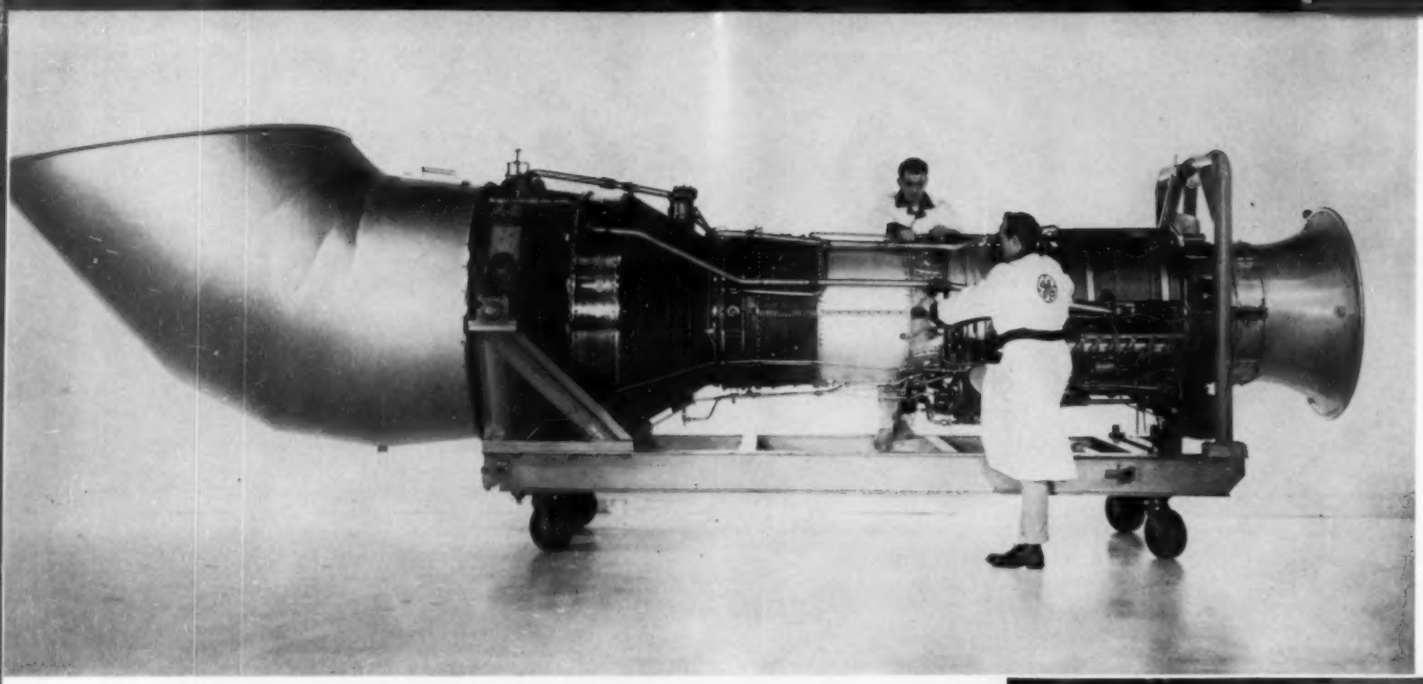
The 104 ft. vessel will utilize hydraulically operated hydrofoils to lift the hull out of the water at "takeoff" speed, thus freeing the hull from drag normally encountered by a displacement vessel. In principle, the purpose of the hydrofoil system is to reduce the wetted area of the ship's hull at increased speed and to maintain the hull entirely clear of the waves when the craft is operating in rough water. "Reducing this to simple terms," explains William P. Carl, president of Dynamic Developments, "hydrofoils are wings that fly through the water. They provide lift (as do wings on an airplane) that raises the hull of the boat from the water and, since the hydrofoils have less drag than the hull of a boat, a hydrofoil equipped craft can go faster than an identical boat without hydrofoils when using the same horsepower engine." With the Carl system of hydrofoils, the main foils or wings are located just forward of the boat's center of gravity and a smaller tail foil is located well aft of the center of gravity (see illustration). This provides stability and quick damping in rough water.

Main propulsion power for the new hydrofoil craft will be supplied by a General Electric model 240 gas turbine engine. This engine will be used to get the vessel "foilborne" and for propulsion in that condition. For harbor maneuvering and displacement operation, a General Electric model 720 gas turbine engine driving two water jet units is employed. Auxiliary power and bleed air for starting the main and maneuvering engine is provided by a pair of AiResearch GTCP85-103 gas turbines.

The model 240 engine for the MARAD hydrofoil is a turboshaft engine modified from GE's J79 turbojet which powers four types of military Mach 2 aircraft. Subsequent versions will use the gas generator from GE's commercial turbojet, the CJ-805. An aero dynamically coupled power turbine has been added aft of the gas generator turbine to convert the jet energy to shaft horsepower. The engine weighs about 6600 lbs., and has a maximum range of 18,000-20,000 shp and continu-

axial flow compressor operating at 12.5:1 pressure

simultaneous continued (shaft and bleed) output



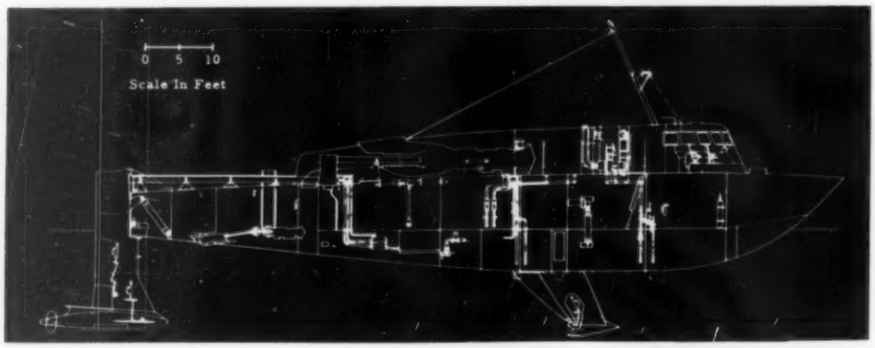
The new model 240 turboshaft engine is shown after undergoing successful qualification testing at General Electric's Large Jet Engine Dept. The 6600 lb. engine developed 19,000 max. hp during tests runs at 5300 output rpm. Engine is rated 14,000 cont. hp for the hydrofoil application.

Getting "feel" of controls during final testing of hydrofoil craft's model 240 turbine engine were Capt. William P. O. Clarke, Jr., and 1st Officer Robert Muncie, who will serve as pilot and co-pilot for MARAD vessel.

ous range of 10,000-15,000 shp. For this hydrofoil application, the engine is rated 14,000 cont. shp on an 80° day with a specific fuel consumption of .55 lb./hp/hr. and power turbine speed of 5,500 rpm. The engine envelope measures 290x 95x65 ins. The model 240's 17-stage single rotor compressor provides a pressure ratio of 12 times external ambient temperature. The mass air flow of over 134,000 cu. ft./min., and high pressure ratio aid fuel economy and high thermal efficiency. Inlet guide vanes and the first six stages of stator vanes are variable to obtain desired performance characteristics over a wide range of engine speeds and ambient conditions. Compressor discharge air is ducted to 10 liners in the "cannular" type combustion section. Combustion gases are directed to the three stage turbine rotor which drives the compressor rotor and engine accessories. The combustion gases discharged from the third stage of the gas generator turbine are directed to the power turbine which converts the exhaust energy into rotary power. Single stage design, with low transition and discharge gas velocities, reduce interstage and residual losses. The power turbine rear stub shaft is splined to receive a conventional flexible coupling and shaft.

The main turbine engine is to be mounted above the main deck in the aft end of the superstructure. Power transmission from the engine to the propeller pod at the bottom of the after hydrofoil will be via a series of six basic sections: upper deck shafting, a single idler reduction gear box, lower deck shafting, an upper strut bevel gear box, vertical strut shafting and a lower bevel gear box in the propeller pod. During retraction of the aft strut a splined disconnect between the lower deck shafting and upper bevel gear box will permit disengaging power to the strut section of the transmission. A three bladed pusher propeller of 36 in. diameter provides thrust for foil borne operation. Transmission and gearing is also being supplied by GE.

Engine output power is regulated by controlling gas generator and power turbine rotor speeds and gas generator fuel flow. Interconnecting control signals are integrated so that the systems function as a single unit in response to the throttle. Power turbine speed and power control are provided at any desired value within the engine-operating range, and are relatively independent of load. The main fuel control is a hydromechanical computor which regulates main engine fuel flow in response to a speed governor. In addition, the control schedules accelerations, decelerations, and the position of the variable stators. The control will also sense power turbine speed and bias the main engine scheduled fuel as a function of engine speed. Overspeed protection for the engine is also provided.



The model 720 displacement engine has a continuous rating of 765 hp with sfc of .71 lb./hp/hr. at a shaft output speed of 6,000 rpm. This is also a free turbine engine with ten stage

axial flow compressor operating at 12.5:1 pressure ratio. Optimum speed of the power turbine is 19,500 rpm which is geared for an output shaft speed of 6,000 rpm. The model 720 drives two Turbopower water jet units, one on either side of the keel, through a right angle gear box which also splits power to two output shafts, one for each jet unit. The 12 in. Turbopower can move up to 7,500 gpm of water through three impelling and straightening stages at a maximum 2,250 rpm. These jet units are larger versions of the ones described in our January 1961 issue. Each jet unit will absorb approx. 350 hp and provide about 2,500 lb. of thrust at the maximum speed. Steering is accomplished by diverting the water jet. The jets will take suction and discharge below the water line. These water jets are produced by Indiana Gear Works Div., The Buehler Corp.

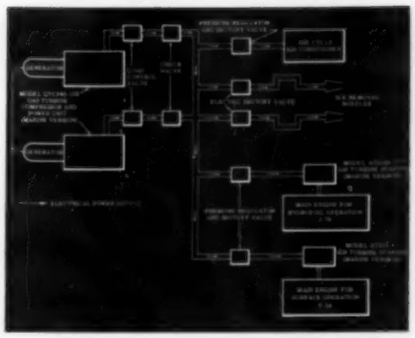
The engine starting and auxiliary power system for the MARAD hydrofoil boat was designed and built by The Garrett Corp.'s AiResearch Manufacturing Div., Phoenix, Arizona. Services provided aboard the hydrofoil by the AiResearch system include: pneumatic main engine starting; electric power generation; compartment airconditioning; compartment heating; snow and ice removal; and motoring of main turbines for maintenance and for fresh water flushing.

Providing those services are two AiResearch GTCP85-103 combination pneumatic and shaft power gas turbine engines. These units are modified versions of the GTCP85-91, currently in production for commercial airline use. The GTCP85-103 can produce singly 116 lbs./min. of bleed air (154 ahp) at a pressure ratio of 3.34:1 on a standard sea level day, or 170 eshp. Its simultaneous continued (shaft and bleed) output is 33.4 ahp and 170 shp. Power is delivered from the turbine in two forms—pneumatic and shaft. The shaft power is used to drive a 60 kva generator.

For main engine starting, bleed air from the AiResearch units is delivered to either of two AiResearch air turbine starters, one mounted on the model 240 and another on the 720 prime mover turbines. Bleed air from the auxiliary turbines is also manifolded to an air cycle air conditioning unit and is also delivered to ports on either side of the crew cabin for snow and ice removal.

The auxiliary power turbines are mounted in a compartment just aft of the crew cabin, and forward of the 240 turbine. The -103 turbine's compressor is a two-stage centrifugal type using two radial outward flow impellers mounted on a common shaft. Air from the intake enters a double entry first stage impeller, is compressed, then flows through a vaned diffuser into crossover ducts leading into a single entry second stage impeller for further compression. Through another diffuser, this air is discharged into the turbine plenum.

The turbine plenum serves as a receiver for the compressor discharge air, and as an enclosure for the combustion tube and torus. This torus mates with the discharge end of the combustor-chamber flame tube and directs the hot combustion gases through a nozzle against a radial, inward flow turbine wheel. Both the turbine assembly and the accessory assembly are connected to the compressor impeller shaft by quill shafts. The turbine accessory section, mounted at the forward end of the turbine, contains an integral drive pad and output shaft and includes a starter, oil pump and filter; fuel pump, filter, governor and shut-off solenoid; a centrifugal three-speed switch, and a fan for oil and driven equipment.

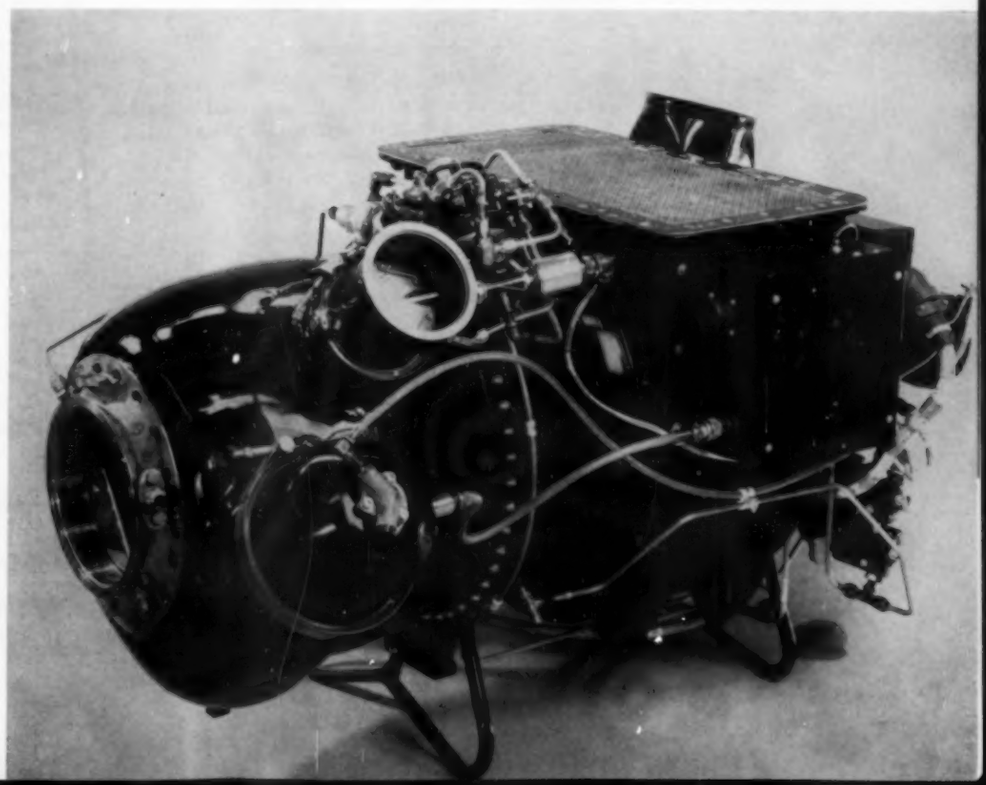


Schematic diagram for main starting and auxiliary power system for the hydrofoil craft.

Electrical power for the hydrofoil system is provided from two General Electric model 2CM-214, B9, 60 kva, 400 cps, 120/208 volt generators. Each turbine mounts one of these generators forward on a 6,000 rpm drive shaft. An air cycle air conditioning system for the cabin takes bleed air from the GTCPs.

Motoring of the main turbines will also be accomplished by using air turbine starters, which convert the auxiliary turbine's bleed air into shaft power to turn the main propulsion turbines. The ordinary function of this operation is to take the prime turbines to starting speed, a 20-30 second operation. In the MARAD hydrofoil, however, duty cycles of two to five minutes will be provided to allow fresh water turbine flushing.

Auxiliary power system for hydrofoil is driven by two of these AiResearch GTCP85-103 small gas turbines. Unit is 37.9 in. long overall, 25.5 in. high with max. 32.5 in. diameter. Turbine produces bleed air from valve at top of turbine plenum and shaft power from drive pad on front, right, where GE 60 kva generator is mounted.



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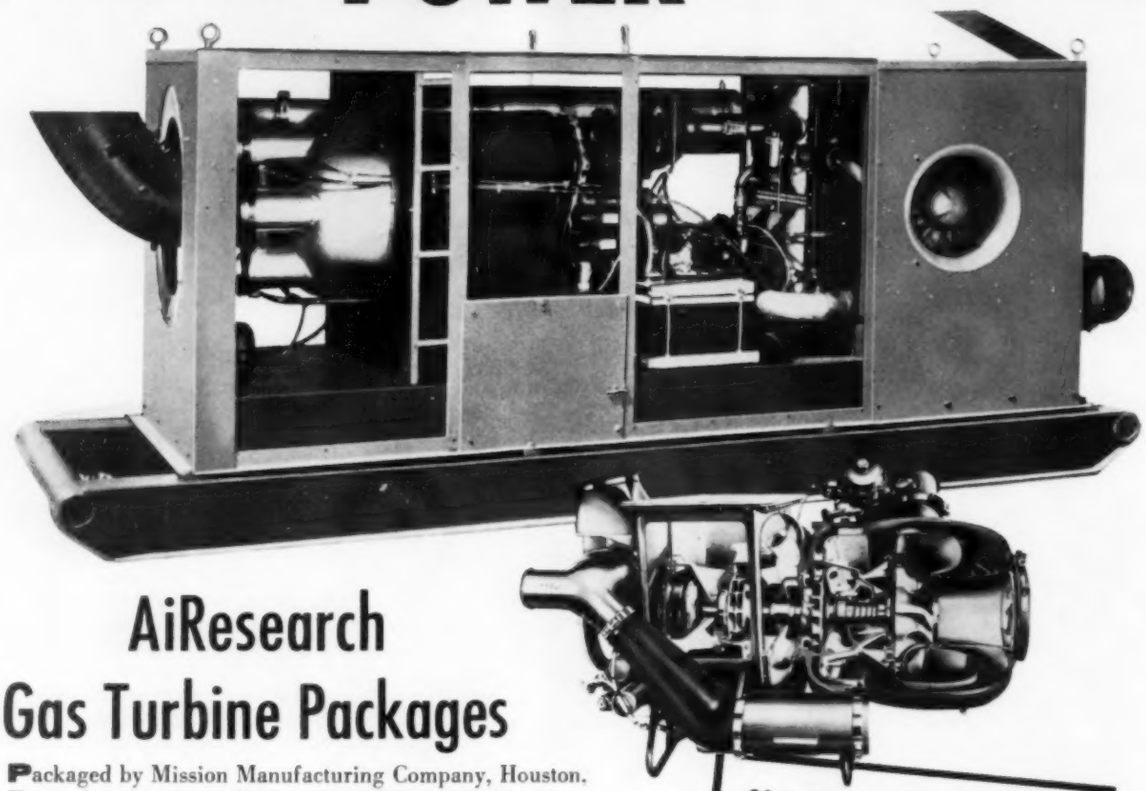

AiResearch Gas Turbine Packages

Packaged by Mission Manufacturing Company, Houston, Texas, the unit pictured above is used for air drilling and is representative of a number of different types of AiResearch industrial gas turbine power packages now available. These lightweight, compact gas turbine packages provide portable compressed air and shaft power for a wide variety of industrial applications.

The basic power package consists of an AiResearch gas turbine compressor and power unit designed around components and accessories proved by laboratory and field testing over a period of years. It is mounted on a skid, enclosed against the weather, with heat exchangers, operating controls and safety devices.

The Mission packaged GTC 105 AiResearch Gas Turbine Compressor Unit pictured above supplies compressed air only. The cutaway Model GTCP 85-91 AiResearch Gas Turbine Compressor and Power Unit provides shaft horsepower and compressed air simultaneously, or either form of power independently and interchangeably. Other models are also available to supply either type of power alone.

AiResearch Manufacturing Division of Arizona is a world leader in the design, development and manufacture of lightweight turbomachinery.

30 to 850 horsepower in a lightweight, compact, dependable package.

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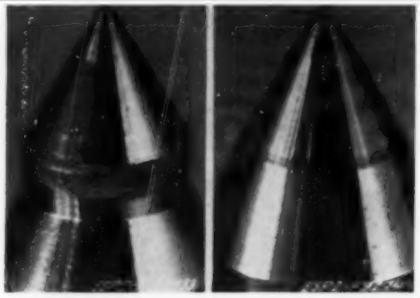
INJECTION NOZZLES WITH "DOUBLE CONE" SEAT

DIESEL nozzle seats with a newly patented design aimed at reducing cavitation erosion caused by high velocity of the fuel are now being supplied by Robert Bosch Corp.

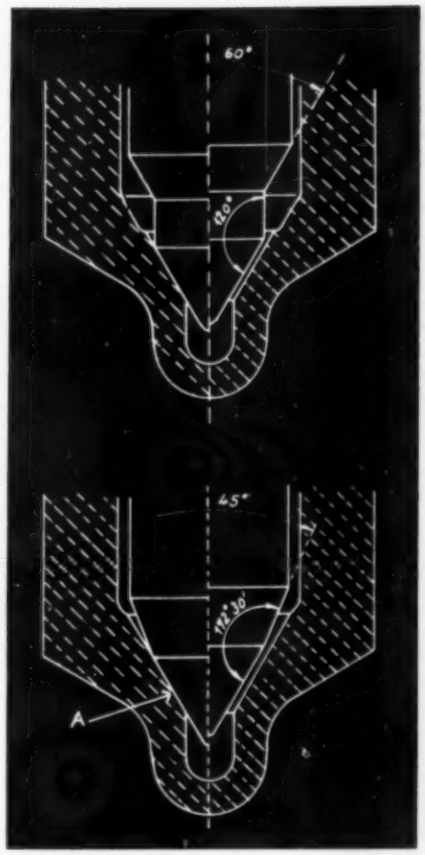
In addition to reducing seat erosion, the new "double cone" nozzle valve and seat configuration has also been found to provide a hydraulic cushioning effect which reduces closing impact and helps prevent pounding of the valve into the nozzle body. The added cushioning also makes possible higher nozzle valve lift for more flow area through the nozzle annulus. Smaller nozzle seat diameters are also possible because higher unit pressures obtained with small diameters can be tolerated.

By referring to the accompanying photographs, the differences in configuration between the old and new nozzle valves is easily seen. The new nozzle valve has a double cone shape unlike the single cone shape of the older Robert Bosch unit. Depending on the application, the difference in the conical angle between the surface of the valve and the nozzle body is up to 20° (usually 10°) on the fuel supply side of the seat and from 0.5-1.5° on the discharge side. The seat is the line contact at the junction of the double cone, a very narrow conical annular surface.

These differing angles help reduce fuel turbulence for lower cavitation erosion and also provide the hydraulic cushion which reduces needle and seat wear. In some engines, the new design has "decidedly extended nozzle life" according to a Robert Bosch representative.



Enlarged views of old (left) and new Robert Bosch nozzle valves. Note "double cone" shape of new unit. Valve seat is the line contact at junction of the double cone. Views also show comparative erosion between old and new configurations.



Drawing of old (top) and new valve seat configurations showing valve open and closed. Actual difference in angles at point "A" is about 30 minutes — 1.5°, difficult to show on drawing.

ANNUAL ADS MEETING AT MINNEAPOLIS

MINNEAPOLIS, Minnesota will be the scene for the 12th annual meeting of the Association of Diesel Specialists from September 14 to 17. Headquarters for the convention will be the Leamington Hotel. A.D.S. officials expect that this year's meeting will attract one of the largest attendances in the group's brief history.

The meeting will include a number of exhibits, talks by several prominent diesel service specialists and a manufacturer's service seminar. A field trip has also been arranged.

A.D.S. members will be introduced to the new organization banner at the Minneapolis sessions. The banner, "unveiled" recently at A.D.S. headquarters in Kansas City, will have its first official use at Minneapolis.

Among recent publications of A.D.S. is the manual, *"This is A.D.S"*, a directory which reflects the unusually fast growth of the association. Included in the directory is a pictorial review of officers and directors, a list of standing committees and a listing of service members in geographical and international sequence. Manufacturer, associate, associate manufacturer and honorary members are also listed. Two pages are devoted to A.D.S. Repair Standards and future meetings are also listed. Single copies of the directory can be obtained free by writing A.D.S. headquarters at 633 E. 63rd St., Kansas City, Mo.

S. E. Franklin, A.D.S. president, examines the organization's newest booklet, "This is A.D.S."

President Franklin and Executive Secretary Martin Fromm display the new A.D.S. banner which will have its first official use at the Minneapolis meeting.

Sales Representative Firm

L. S. Haynes, Jr., and C. R. Orwick have formed Hopco Engine Service, a sales representative organization with a number of service accounts for users of large bore gas and diesel engines in an eight-state midwest area. The company calls on municipal power and sewage plants, pipelines, railroads and the industrial and marine operators of large engines. The firm was formerly known as the Haynes-Orwick Co. Offices are located at Overland Park, Kans., and Jackson, Mich. Among companies represented by Hopco are Piston Products, Inc., U. S. agents for Daros rings and liners; Eldorado Mfg. Corp., and Van der Horst Corp., of America.

Purolator Subsidiary

Purolator Products, Inc., through its wholly owned European subsidiary, has established a sales organization in Germany to distribute filters and filtration products. Dr. Rudolf Hoss has been appointed general manager of the new subsidiary which will be headquartered in Stuttgart. Under present arrangements, the new subsidiary will provide sales and service facilities for the line of filters and replacement elements manufactured by Purolator Products, Inc., Rahway, N. J. Purolator Products A. G. which is headquartered in Zug, Switzerland, will provide direction for the new subsidiary while continuing to serve its present markets which include England, France, Spain, Italy and the British Commonwealth.

Prime Mover Controls Conference Dates Set

Woodward Governor Co.'s 25th Prime Mover Control Conference will be held at its Rockford, Ill., plant from September 5 through September 8. It is open to all domestic and foreign industries employing hydraulic governors in their own operations or as original equipment on their products. Interested branches of the U. S. and foreign governments are also invited to attend. A formal program of classes, discussion sessions and workshop activities is scheduled. Comprehensive coverage of the engineering fundamentals and operating principles of hydraulic prime mover controls is planned for such fields as hydro-electric, railroad, diesel, marine, petroleum, steam, aircraft, gas turbine and others.

Piston Ring Catalog

Piston Products, Inc., has published a 12-page piston ring price catalog for large bore (8 in. to 30 in.) diesel and gas engines used pipeline, power plant, marine, and heavy industry. In addition to a simplified pricing schedule, this booklet includes descriptive application data on the various types of piston rings illustrated; also, technical information on piston ring materials, information on Daros anti-corrosive cylinder liners, and data on use of "Wear Rings" in worn piston grooves. A copy can be obtained by writing Piston Products, Inc., 7324 N. Lawndale Ave., Skokie, Ill. (ITS NEW)

Engines For Crushing Plants

Power units and electric sets for crushing and asphalt plants are described in a new 8 page catalog (BU-768) now available from the Engine-Material Handling Division, Allis-Chalmers Manufacturing Co. The catalog is complete with pictures of the various units, along with a cutaway view of the Allis-Chalmers "Thousand Series" diesels and illustrations showing important components of the engine and its combustion chamber. Tables giving horsepower requirements of the power units and electric sets for crushers and asphalt plants are included, along with photographs showing the two units in action. Copies may be obtained by writing the Division at Milwaukee 1, Wis. (ITS NEW)

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Cleaner-Snubber Bulletin

The Industrial Silencer Division of Burgess-Manning Co. has published a new, 6-page bulletin on its type SDF combination cleaner-snubber. The unit is designed to be used in place of separate air intake filters and silencers for reciprocating compressors, positive-displacement blowers, and naturally-aspirated or positively-scavenged gas or diesel engines. The combination unit offers substantial advantages by eliminating extra piping, and operation and maintenance of separate equipment for air intake cleaning and silencing, according to the literature. Units are available in 8- to 30-inch inlet and outlet connection sizes, in rated capacities of 1,400 to 19,600 cfm. Copies of the bulletin may be obtained by writing Burgess-Manning Co., 9207 Sovereign Row, Dallas 7, Tex. (ITS NEW)

OGP Conference Date

The American Society of Mechanical Engineers Oil and Gas Power Division Conference will be held at the Shoreham Hotel, Washington, D.C., from April 15-18, 1962.

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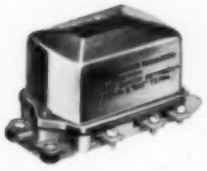
- Simplified external adjustment feature quickly tailors voltage to job
- Waterproofing insures long life and reliable operation



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- Accurate voltage control at all generator speeds
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- Available for either indicator light or ammeter circuits

FULL-TRANSISTOR REGULATOR
- No moving parts to wear out
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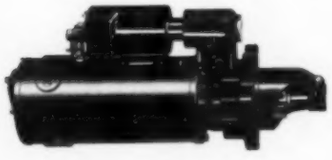
- Simplified external adjustment feature—permits tailoring voltage to operating conditions



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DC-250 HIGH-DUTY BATTERIES
- Glass mat retainers protect positive plate material—improve cycling ability, provide longer service life
- Resin seals between cell cover and terminal and between case and cell cover protect plates and separators from vibration damage and prevent electrolyte loss
- Newly formulated positive plate material withstands vibration and cycling damage—delivers dependable power during longer life span of DC-250

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MD Type Diesels for Trawlers

The first order for Bristol Siddeley Maybach high-speed diesel engines for a British marine application includes twelve type MD 225 Bristol Siddeley Maybach diesels, each of 394 bhp. The engines will power six new trawlers to be built by T. Mitchison Ltd. of Gateshead to the design of Burness Corlett and Partners. For middle water operation, the trawlers are single-screw vessels of hydroconic form. With a registered length of 115 ft. 6 in. and a moulded breadth of 25 ft., they have a loaded speed of approximately 11 knots. The two engines installed in each vessel will be coupled to a single controllable pitch propeller through a twin input, single output reduction gearbox—from which a drive will also be taken to the winch generator. The generator, like the propeller, can be driven by either or both engines. The MD range of engines is manufactured in England by Bristol Siddeley under license from Maybach Motorenbau GmbH of Freidrichshafen. All the units in the MD range are four-cycle engines using throughout a common bore and stroke: 185 mm (7.28 in) 200 mm (7.88 in). The cylinder arrangement is in-line for 4 and 6-cylinder models, and in Vee formation for 8, 12 and 16-cylinder versions. All engines in the MD range are fitted with exhaust driven turbochargers and, in addition, may be equipped with intercoolers for increased power where necessary.

Form International Unit

Eaton Manufacturing Co., has established a new division to be known as Eaton International to consolidate in one central organization the company's foreign activities. E. M. de Windt, vice president of the corporation, has also been named president of Eaton International. In recent months, the company obtained a majority interest in Eaton Livia S.p.A. of Turin, Italy, and a substantial minority interest in Eaton Axles, Ltd. of England.

Custom Housings Facilities

Custom built boxes, cabinets, consoles, cubicles, panels, and allied enclosures can now be handled by the new design and production facilities offered by Armesco, Inc. Armesco specializes in the custom construction of all types and sizes of metal enclosures and panels for the housing or mounting of control instruments. Housings or panels can be supplied in aluminum, steel, or stainless steel. Special requirements for individual applications are also handled. For information write Armesco, Inc., Lansing & Bingham Sts., Philadelphia 11, Penna.

Waukesha V. P. Retires

Mr. J. G. Swain, Vice President of the Waukesha Motor Co., manufacturers of heavy duty internal combustion engines has announced his retirement. Mr. Swain served as an officer of the company since 1949 and has been a member of the board of directors for the past 28 years. He first joined the Waukesha Motor Company in 1917 and has an uninterrupted record of service since 1925. He will continue as a director.

New Control Unit

A new line of infinite-positioning, self-locking quadrant control mechanisms that can be applied to a number of applications, including throttle or governor control for diesel engines. The new unit, called the Quadrastat, employs a patented, automatic, self-locking principle which permits infinitely-variable, positive-positioning of the control handle, but prevents changes in setting caused by engine vibration or any other "feed-back" forces acting through its driven lever. The mechanism automatically locks itself in position wherever the handle is stopped. It automatically unlocks itself whenever the handle is moved again. Further information may be obtained by writing to Adams Rite Manufacturing Co., 540 W. Chevy Chase Dr., Glendale, Calif. (ITS NEW)

AiResearch Distributor

Appointment of Southwest Industries, Inc., of Houston, Tex., as exclusive distributor for the sale and retrofit installation of AiResearch turbochargers on existing 2-cycle natural gas engines, has been announced by the AiResearch Industrial Division of The Garrett Corp. Primarily, efforts will be directed toward petroleum and petro-chemical installations, including gas transmission, to provide increased power output economically. Territory for the contract with Southwest Industries covers 12 states.

New Hydraulic Accumulator

Three functions are performed by a new oil-hydraulic accumulator. One is that of a power storage chamber so a low volume pump can supply a large amount of energy for a brief moment. The second is that of a pressure compensator to maintain system pressure so holding cylinders do not lose their grip. The third is to eliminate surges and vibration, smooth out pressure pulses and prevent shock from fast-closing valves. Its weldless steel outer shell is made in one piece by spin-forging. Hollow aluminum piston is statically balanced, includes double Quad-Ring seals. It is proportioned to despense a maximum amount of fluid with a minimum gas charge and no danger of pressure lock. Six models are offered for 3,000-psi. service, four others for 3,500-psi. service. Stock size ranges from 1 pt. to 2½ gal. overall. Oil volume is 29 to 230 cu. in. for the 3,000-psi. models, 230 to 575 cu. in. for the others. For more information write Crescent Hydraulic Co., 1303 Otsego Rd., Allegan, Mich. (ITS NEW)

Spark Conversion Brochure

A four-page folder on a new spark ignition conversion kit for converting series 71 General Motors diesel engines to operate on natural gas is now available from Stewart & Stevenson Services, Inc. The firm developed the conversion method to permit diesel operators to reduce operating costs in areas where low-cost natural gas is available. The kit can be used on both current and older series 71 General Motors diesels. Converted engines develop full rated horsepower and have excellent acceleration and lugging characteristics. The free brochure can be obtained from Stewart & Stevenson Services, Inc., 4516 Harrisburg Blvd., Houston 11, Tex. (ITS NEW)

GN

Pedrick

SUPERIOR

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MACHINE WORKS

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Precision Cleaning Unit

The Pioneer-Central Division of The Bendix Corp. has developed a three stage cascade rinse unit designed to complement its line of Sonic Energy cleaning systems. Bendix now offers three types of rinse units; spray, immersion and cascade. The requirement for more precise rinsing techniques arose originally in the semi-conductor industry and has since spread into the precision electro-mechanical and hydro-mechanical industries according to J. H. McGinnis, marketing manager for Sonic Energy Products of The Bendix Corporation. The cascade rinse unit has three rinse stations. The rinse solution is pumped into the first station, overflowing into the second and subsequently into the third station where it is drained for subsequent rejuvenation and recirculated. Parts being rinsed are submerged in chamber three followed by submersion in two, and subsequently in chamber one, the cleanest of the three stations. After rinsing, parts are normally dried in a forced air dryer. For more information write Pioneer-Central Division, The Bendix Corp., Davenport, Iowa.

Nation's largest manufacturer of heavy-duty and specialized engine parts—

NEW GOULD-NATIONAL ENGINE PARTS DIVISION

In creating its new Engine Parts Division, Gould-National combined under one corporate roof the brands, products, services and facilities of these wholly-owned subsidiaries:

Wilkening Manufacturing Co., Philadelphia, manufacturers of Pedrick® piston rings and castings.

White Machine Works, Eau Claire, Wisconsin, manufacturers of Superior-Arrowhead cylinder sleeves, sleeve assemblies, pistons, piston pins, Burd piston rings, valves and valve train parts, foreign car engine parts and filters.

Gillett & Eaton, Lake City, Minnesota, piston and casting specialists of cast iron, aluminum alloy, Vanasil® aluminum alloy pistons and specialized engine parts.

Arrow Head Steel Products, Howell, Michigan, manufacturers of aluminum pistons, connecting rods and other castings.

Now, Gould-National, the nation's largest producer of automotive replacement batteries, is also the nation's largest basic manufacturer of heavy-duty and specialized engine parts. The Division is the largest one stop source for the most complete line of engine parts available from one manufacturer. It is the only engine parts manufacturer with both iron and aluminum casting and machining facilities.

By utilizing the efforts of one combined sales force, the customer will benefit from greater sales-service efficiency, more concentrated field coverage.

Product improvement will result from the formation of a special team in the Gould-National Engineering and Research staff. It is the Gould-National way of assuring continuing top quality and improved product performance.

New engineering developments, manufacturing and production techniques from all areas within the Division will benefit all customers, no matter what the product may be.

This is the Gould-National Engine Parts Division—the nation's newest parts manufacturing group with over two centuries of combined experience.

Need heavy-duty engine parts? Automotive engine parts? Foreign car engine parts? Parts for such specialized applications as air and refrigeration compressors? Need complete and modern facilities for aluminum and iron castings? If your specifications call for the best of these, if you need them fast and need them right . . . turn to . . .

Superior-Arrowhead and Burd are trademarks of Gould-National Batteries, Inc.

GN

ENGINE PARTS DIVISION
GOULD-NATIONAL BATTERIES, INC.
St. Paul 1, Minnesota

Amot Representatives

Frost Engineering Service Co., headed by Vernon Frost and Jack Crawley have been appointed Southern California and Western Arizona representatives for Amot Controls Corporation of Richmond, Calif., manufacturers of safety controls, thermostats, valves and switches. Their offices are at Huntington Park, Calif. Frost Engineering takes over the territory previously served by Flournoy and Everett for nearly a decade, who have retired from the industrial field. Woodrow Wood, formerly with Flournoy & Everett, will be associated with the new representatives as sales engineer. He will continue to aid in marine, industrial, oil and gas contruction fields with the line of Amot Controls.

GM Diesel on Dozer

A 290 hp General Motors diesel engine is now available as optional equipment on the Michigan model 280 tractor dozer, according to the Construction Machinery Division of Clark Equipment Co. Designed to increase the tractor dozer's flexibility and production, the new engine is a General Motors model 8V-71. It features a two-stroke engine cycle, unit injector fuel system, and maximum parts interchangeability. Also available for the model 280 is the 262 hp Cummins NTO diesel. Driven through the Clark power train, the model 280 has a top speed of 28 mph in forward or reverse. The drive line consists of a Clark industrial type 3 to 1 multiplication factor torque converter, four-speed power shift, and all-wheel drive. The Model 280 has rear-wheel steering and a front axle with locking type differential. For further information write the Construction Machinery Division, Clark Equipment Co., Pipestone Plant, Benton Harbor, Mich.

Donaldson Plans Building

Donaldson Co., Inc., manufacturers of air cleaners and mufflers for internal combustion engines, has announced it will build a general office building and research center at Bloomington, Minn. To be constructed are a one-story, 27,000 sq. ft. office building; a one-story 21,200 sq. ft. research and development facility and a combination boiler house and garage.

AVAILABLE NOW! The completely new 1961 edition of the **DIESEL AND GAS ENGINE CATALOG,** Volume 26, can now be purchased. If you design, purchase, sell, operate or service diesel, dual fuel, or gas engines, the Catalog is essential to you and your business. This giant, 608 page, 10½ x 13½", fully illustrated reference book has been rewritten, revised and brought up to date completely from cover to cover and costs just $10 postpaid anywhere in the world. Send checks, money orders or company orders to **DIESEL AND GAS ENGINE CATALOG,** 10850 Riverside Dr., North Hollywood, Calif.

Anniversary Observed

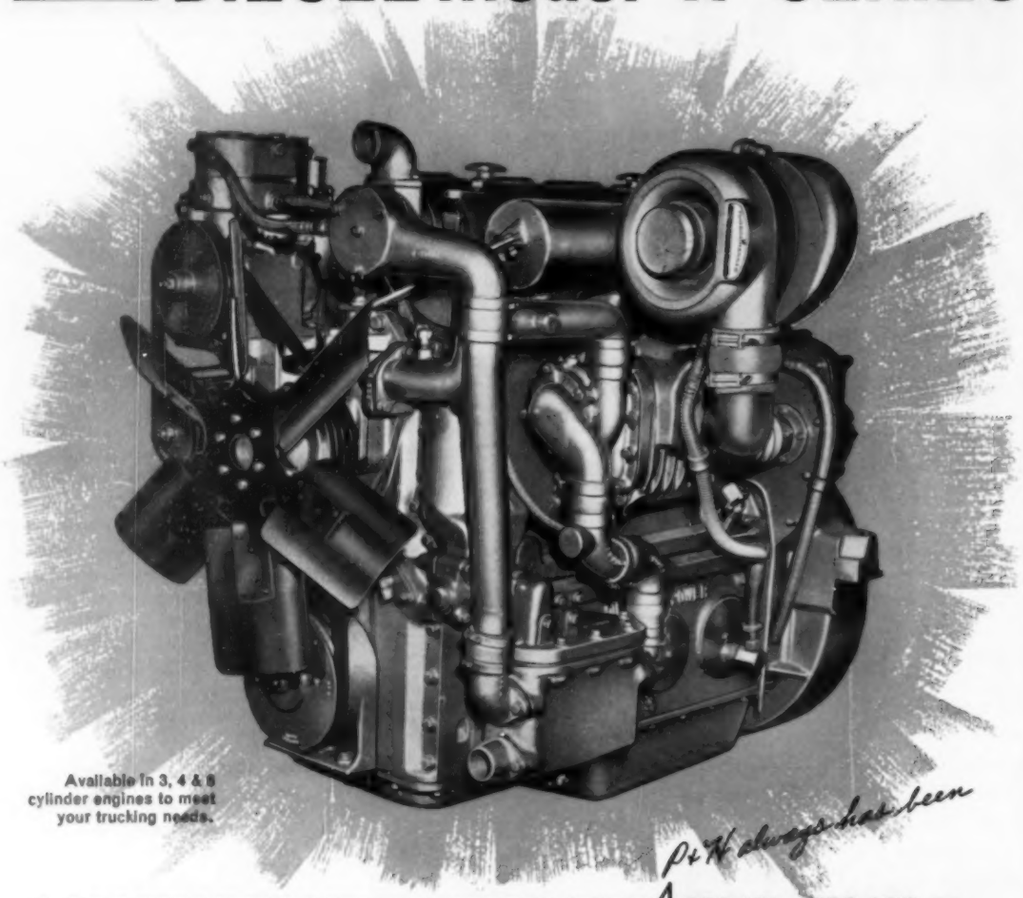
The 50th anniversary of Viking Pump Co., is the subject of the Summer issue of *Viking Vacuum*, the firm's house organ. The issue reviews some of the history of Viking and also outlines production methods and controls utilized in building the pumps with a "gear within a gear". Distributors and suppliers with long-time service to Viking are also listed. For a copy of the anniversary issue write to Viking Pump Co., Cedar Falls, Iowa.

Facilities Described

A new 16-page two color brochure describes Kurz and Root's design, engineering and manufacturing facilities for aviation, missiles, space vehicles, automation controls, industrial, municipal, public utilities, transportation and marine. It illustrates plant operations and standard products in electronic, electrical, military, and commercial industries. Opening sections are headed "Yesterday, Today, Tomorrow"—the title of the brochure. A copy may be obtained from Kurz and Root Co., Appleton, Wis. (ITS NEW)

IT'S MODERN...IT'S DIFFERENT...IT'S HOT

P&H DIESEL model "H" SERIES



Available in 3, 4 & 6 cylinder engines to meet your trucking needs.

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LIGHTWEIGHT ALUMINUM 220 HP—1500 LBS. or only 6.82 LBS. per B.H.P.

power...to match the most powerful
mileage...to match the most economical
serviceability...unmatched by any other "make"
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compare...feature for feature and you will specify the *new* P&H Diesel—Model "H" Series

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HARNISCHFEGER CORPORATION
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Water Resources Report

The United States can meet its soaring water demands in most areas over the next 20 years, but at minimum it will cost from $54 billion to $74 billion for new dams, reservoirs, and waste treatment facilities, depending on which of alternative methods are chosen to keep river flows sufficiently clean. This is the conclusion of a report by Resources for the Future, Inc., Washington, D. C., a privately-endowed research foundation, made under contract for the Senate Select Committee on National Water Resources, and released by Senator Robert S. Kerr of Oklahoma, committee chairman. The report was based on surveys of future water demands and potentially available supplies, made for the Committee by the Federal water resources agencies over the past two years. It was prepared by Dr. Nathaniel Wollman, Professor of Economics, University of New Mexico, on detail to Resources for the Future, Inc. It forecasts water supply needs and prospects for meeting them for all parts of the country except Alaska and Hawaii, where water problems are not physically related to the rest of the States. The report finds that trends in water use indicate that an average 559 billion gallons will be required daily by 1980 to meet projected agricultural, manufacturing, steam-electric, municipal and mining uses, if the population and economy expand at an estimated medium rate. This is almost double the country's average 300 billion gallons daily requirement for these purposes in 1954.

F-M Rotary Compressor

A new bulletin describes a heavy-duty Fairbanks, Morse rotary compressor for general purpose services, including those requiring delivery of oil-free air, gas or vapor. Listed are performance coverage—capacity up to 21,000 cfm and pressure up to 250 psig. Applications are in the chemical, petro-chemical industries and heavy mass-production industries. For a copy of Bulletin ACO 100-4 write A. C. English, general manager, Compressor Division, Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill. (ITS NEW)

Hose Fittings Guide

A reference bulletin to be used as a quick guide to Aeroquip hose assembly numbers has been released. The bulletin, IEB-53, covers the various categories of end fittings (J.I.C., and S.A.E., etc.). It also provides the hose types to be used with each type of fitting. Copies of the bulletin may be obtained by requesting IEB-53 from the Advertising Department, Aeroquip Corp., Jackson, Mich. (ITS NEW)

Double Cleaning Treatment For Turbocharger Oil Passages

Center housings of AiResearch turbochargers are reaching the assembly line with critical oil passages doubly clean, following detergent and oil baths in custom designed apparatus. To achieve this engineers at The Garrett Corporation's AiResearch Industrial Division have developed two specialized rigs. In the first cleaning stage a special metal probe is placed into the bearing bore of each housing. The probes have about 100 tiny holes drilled at proper oil passage alignment angles. Using a dual hose attachment, detergent phosphate at 50 psi pressure and 140° temperature, and air at 50 psi, are alternately pumped through. Simultaneously, the housings are immersed in a tank of the detergent, providing the outside surface with a coating of phosphate that acts as a rust preventive until each unit is painted. After painting has been completed, the units are put through another cleaning session, this time by through flushing in normal flow direction with hot oil. The unit is clamped into an airtight fitting, and oil is pumped through under 75 psi pressure at 180° temperature for approximately five minutes. This has the same effect as the run-in period on an engine, serves to loosen and remove any particles that might have withstood the detergent bath. It also provides a protective oil coating internally.

Manufacturer's Representative

Miles Powell, vice president in charge of sales for Spray Products Corp., Camden, N. J., announces appointment of the J. Paul Saunders Co., Bowling Green, Ky. as their representative for the states of Kentucky, Tennessee, Mississippi and Alabama. Spray Products produces pressurized diesel starting fluid, Spray Nuts Off, Diesel Pep and several other items.

Sheller Named Vice President

A. Foster Sheller has been named vice president of manufacturing of the Waukesha Motor Co. Mr. Sheller will supervise and coordinate activities of the departments within the organization directly concerned with, or closely related to the manufacturing process.

Master Service Awards

Two Nashville, Tenn., men—Howard Ward and Ben Carey—have been awarded Master Technician certificates of Melrose Technical Institute, service training center of International Harvester Company's Construction Equipment Division. Ward and Carey are employes of Power Equipment Company, 800 Sixth Avenue North, Nashville, International construction equipment distributor. To qualify as Master Technicians, Ward and Carey were required to have eight years' continuous experience on International construction equipment (including three years' field experience), responsibility for shop administration for at least two years, completion of a minimum of 50 courses at Melrose Tech and the presentation of at least 25 instructional courses.

Pressure Switch

A small, lightweight device which opens or closes an electrical circuit when pressure, differential pressure, or flow becomes too high or too low has been developed by Pall Corp. These adjustable Deltadyne pressure and differential pressure switches provide reliable indication over the range from 15 to 200 psid. Within the pressure range of a given switch, actuation pressure may be altered by turning a direct reading dial. Units can withstand system pressures or overpressures up to 5000 psi. The units are suitable for use in industrial and airborne systems. For further information, contact Martin Wank, Pall Corp., 30 Sea Cliff Ave., Glen Cove, N.Y.

ITS NEW

PERFECT CIRCLE PISTON RINGS ARE INSTALLED AS ORIGINAL FACTORY EQUIPMENT IN 94 BRANDS OF VEHICLES AND ENGINES
WHY THE PROS PREFER PERFECT CIRCLE PISTON RINGS...
RADIAL-ACTIVE DESIGN
ASSURES BETTER CONFORMABILITY

The basic metal used in Perfect Circle rings is specially selected for its active, spring-like qualities. And, each ring is carefully engineered to distribute its radial pressure properly for maximum conformability, even in tapered and out-of-round cylinders.

This radial-active design results in sustained compression, less blow-by and positive oil control.

It's one of the many reasons why leading engine and vehicle manufacturers, fleet operators, race drivers and mechanics the world over prefer and specify Perfect Circle piston rings.

For lasting performance, always install genuine Perfect Circles—the rings the "pros" prefer.

PERFECT CIRCLE

PISTON RINGS • POWER SERVICE PRODUCTS

HAGERSTOWN, INDIANA · DON MILLS, ONTARIO, CANADA

NEW PC VALVE SEALS

Stop oil loss past valve guides, reduce valve sticking. For superior performance, install PC Valve Seals with every ring job

V-Belts Bulletin

Design features of all R/M V-Belts are detailed in a new 8-page bulletin issued by Manhattan Rubber Division of Raybestos-Manhattan, Inc. Included are R/M Condor V-Belts and patented R/M FHP V-Belts, both offering special designs for heavy and light duty, short and long center applications. For copies of R/M V-Belt Bulletin M-201, write: Manhattan Rubber Division, Raybestos-Manhattan, Inc., Passaic, N. J. (ITS NEW)

Government Sales Manager

The Detroit Diesel Engine Division of General Motors announced appointment of Stanley C. Partel as manager of the Division's Washington office for government sales. He succeeds J. Kenneth Hampton recently retired and currently operating as a Detroit Diesel consultant. Mr. Partel had been assistant to Mr. Hampton in the Washington office since 1957. Fay Marvin, who has been associated with Detroit Diesel's government sales department in Detroit, has been appointed assistant to Mr. Partel in the Washington office.

Great new things are coming from **AMERICAN BOSCH!**

YEARS AHEAD IN DESIGN... *available now!*

Here is a new, low-cost, multi-cylinder fuel injection pump that's simplicity itself . . . that's unusually compact, yet does a man-size job . . . that lets you cut your equipment costs and improve efficiency at the same time.

Fewer parts and the patented American Bosch hydraulic head permit quick, easy servicing. Moreover, the PSU will handle a wide range of commercial fuels, enabling engine manufacturers to develop power plants with multi-fuel capabilities.

If you have a diesel engine in the planning stage—or even on the drawing board—it may pay you to stop where you are and take a long, hard look at this new American Bosch PSU diesel fuel injection pump. Write today for full details. 8274

MOVE AHEAD

AMERICAN BOSCH ARMA CORPORATION

Commercial Sales Division • Springfield, Massachusetts

Diesel Fuel Injection Systems

Ensign Carburetion

Hydraulic Cranking Systems and Accumulators

Automotive Electrical Equipment

Magnetos and Ignition Equipment

Compressor Bulletin

Just published, new Bulletin 189 presents Clark high pressure packaged compressor systems for military, commercial, laboratory and pilot plant use. Among the features described and illustrated are: Balanced/Opposed design to eliminate vibration; high performance compressor cylinders (pressures to 10,000 psig); crosshead type construction; adaptability to synthetic lubricants; unitized assembly complete with motor driver, intercoolers and all accessories. Copies of Bulletin 189 can be obtained by writing to Clark Bros. Co., Division of Dresser Industries, Inc., Olean, N. Y. (ITS NEW)

Two New Recorders

The Esterline-Angus Instrument Co. has introduced a new two-pen recorder and an analog-event recorder. The two-pen recorder simultaneously graphs, on a single chart, any information which can be expressed in an electrical current or voltage. Its recording range is from microamperes to thousands of amperes and from microvolts to thousands of volts. In checking electrical circuits, one pen records amperage while the other records voltage, thus producing side by side synochronized graphs which reveal the effect of voltage variation on amperage. The instrument will accommodate any data which can be expressed as an ac or dc voltage, ac or dc current (including dc milliamperes and dc microamperes). In addition, ac watts, kva, kvar, pressure speed or vacuum can be recorded. On a main production line, for example, the instrument's event pens will record the flow of parts from six feeder lines and relate this information to operation of the main line. This will show whether or not all lines are properly paced, which in turn, has a direct bearing on productivity. The recorder case is 10¾ in. wide, 16 in. high and 11 in. deep. Analog and event data are recorded on a single 6 in. wide strip chart, with analog information in the center three inches and event information on the margins. Write Esterline-Angus Instrument Co., 1201 Main St., Speedway, Ind. (ITS NEW)

Open Training Center

A new training center providing a factory supervised training program for Allis-Chalmers construction machinery dealers' service personnel has been completed at the firm's Springfield, Ill., plant. The new training center covers more than 17,000 sq. ft. and will bring all phases of the company's construction machinery division dealer service training program into one facility at Springfield.

2 New LW Haulers

With introduction of two new end dump models, LeTourneau-Westinghouse Company's Haulpak line now covers the size range for off-highway haulers, from the 22 ton to the largest, new 60 ton truck. Announcement of the new model 42, and the model 60 Haulpak Truck was made recently. The LW model 60 Haulpak truck utilizes extra high yield strength steels and fabricated units in construction. It weighs 33 tons and is capable of hauling a pay-load almost twice its own weight. It is powered with a 550 hp Cummins, V-12 model VT12-700 turbocharged diesel engine, and Allison CLBT-5940 Torqmatic transmission with 6 speeds forward, and has a top speed of 46.6 mph. The LW model 42 Haulpak truck is powered with a 430 hp Cummins, V-8, model VT8-430 turbocharged engine and the 6 speed Allison CLBT-5940 transmission. It is capable of a top speed of 47.7 mph.

Muffler Parts Catalog

A publication recently issued by Alexander-Tagg Industries, Inc., illustrates and describes their line of heavy duty exhaust system parts and accessories. Fifteen ATI parts and accessories are shown and described. The reverse side of the publication contains a chart showing application data for all ATI heavy duty truck and bus muffler parts and accessories. For a free copy, write Alexander-Tagg Industries, Inc., Hatboro, Pa. (ITS NEW)

Booted Universal Joints

A new line of booted universal joints has been especially developed for severe service applications. The joints are fitted with oil-resistant Neoprene covers which allow them to be pre-packed with grease. The cover or boot is held firmly in place by snap wires and can be quickly and easily removed or replaced in the field. It in no way affects performance of the joint, allowing operation through a full 40° working angle. For further information contact Lovejoy Flexible Coupling Co., 4867 W. Lake St., Chicago 44, Ill. (ITS NEW)

Charger Control Unit

Maintenance time and expense can be reduced and the lives of lead-acid and nickel-cadmium stationary batteries lengthened, by coupling a new automatic control unit with one of Exide's recently introduced models of general-purpose, two-rate battery chargers, the firm states. Eliminating need for manual adjustments except for routine maintenance, the new Exide automatic charge control unit varies the charge rate of the rectifier as required by the battery and prevents overcharge or undercharge damage. The control unit is designed as a mate for economical, versatile Exide Hi-Lo Charger models used with batteries such as those that supply stand-by or intermittent power. When the voltage of a battery drops below a full-charge value, the control unit puts the charger on high rate. After full-charge voltage is reached, the unit switches the charger back to a low trickle-charge maintenance rate. The control unit makes an accurate check of the state of battery charge every hour. Further information on the new Exide automatic charging control units can be obtained from Exide Industrial Marketing Division, The Electric Storage Battery Co., Rising Sun and Adams Ave., Philadelphia 20, Pa. (ITS NEW)

Napier Board Member

P. J. Daglish, who joined D. Napier & Son, Ltd., as a special executive last September, has been appointed to the board as commercial director. Before joining Napier Mr. Daglish was manager of English Electric Company's Aircraft Equipment Division, which he established in 1953. The division now provides a wide range of equipment for aircraft built in Europe and the U.S.A., and it was responsible for introducing into Britain constant frequency ac electrical systems for aircraft.

Retires at Diamond T

Diamond T Motor Truck Co. has announced the retirement of Joseph L. Krickl, assistant to the president. Mr. Krickl, a well known figure in the automotive industry, had a long and distinguished career at Diamond T. He joined the truck manufacturing firm in the hard-tire, four-cylinder days, in 1916, resuming his duties after his discharge from the Army at the end of World War I. He was instrumental in building the Diamond T dealer organization to its present position and was advanced to his latest position some three years ago.

Alco Exchanger Orders

Alco Products, Inc. has received two orders amounting to approximately $800,000 for a total of 75 heat exchangers to be manufactured at its plant at Dunkirk, N. Y. The orders were placed by the Bechtel Corp., engineers and constructors, of San Francisco, Calif. The larger order is for 47 heat exchangers to be used in a benzine plant which Bechtel is constructing for the Texaco Company at Port Arthur, Tex. The other order is for 28 heat exchangers to be used in a synthetic ammonia plant now under construction at Fort Madison, Iowa, for the California Chemical Co.

Power Chief Distributor

Appointment of Sondo Sales Co., Tulsa, Okla., as oil fields distributor of Power Chief Engines in the Mid-Continent area and Canada was announced by Nordberg Mfg. Co. In addition to sales offices and warehouse facilities in Tulsa, Sondo Sales will maintain parts warehouses in Pampa, Texas and Great Bend, Kan.

AVAILABLE NOW! The completely new 1961 edition of the **DIESEL AND GAS ENGINE CATALOG,** Volume 26, can now be purchased. If you design, purchase, sell, operate or service diesel, dual fuel, or gas engines, the Catalog is essential to you and your business. This giant, 608 page, 10½ x 13½", fully illustrated reference book has been rewritten, revised and brought up to date completely from cover to cover and costs just $10 postpaid anywhere in the world. Send checks, money orders or company orders to **DIESEL AND GAS ENGINE CATALOG,** 10850 Riverside Dr., North Hollywood, Calif.

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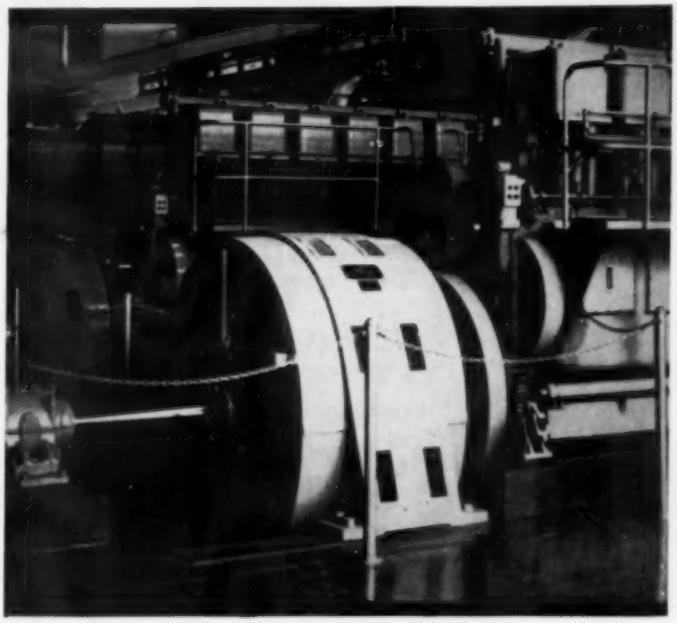


Six IDEAL 956 kw, 1195 kva, 60-cycle, 3-phase alternators, with V-belted 15 kw exciters, each driven by a 4-cycle, 8-cylinder turbocharged Nordberg diesel engine, provide an unfailing power source at Vandenberg AFB in California – the free world's first operational and training ICBM and IRBM base.

Operated in pairs on an alternating 36 to 48-hour basis, these units supply uncompromising power for uninterrupted operation of the Atlas complex and will serve in missile launching in an emergency with ample reserve capacity well beyond anticipated power requirements.

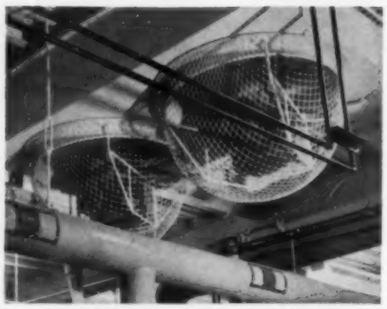
Over the initial 8-months of operations, the generating plant, which is rated at a total capacity of 8,064 hp and 5736 kw, produced 4,200,000 kw/hrs. By mid-1960, the load virtually doubled as additional facilities were completed. Besides its primary mission in Atlas operations, the present installation will ultimately furnish electric power to three additional complexes on the base, slated for completion later in the year.

Write for Bulletin 510 or contact your Ideal representative

The IDEAL ELECTRIC & MANUFACTURING COMPANY
614 East First Street Mansfield 4, Ohio

SINCE 1903, MANUFACTURERS OF PRECISION MOTORS, GENERATORS MOTOR-GENERATORS SETS, SWITCHGEAR AND CONTROLS

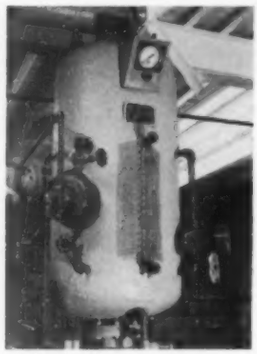
VAPOR PHASE® COOLING at Diamond Bar Water Company INCREASES USABLE HORSEPOWER



Vapor Phase Cooler mounted in roof, condenses steam from both engines and provides lubricating oil cooling.

At the new booster pumping station of the Diamond Bar Water Company in Southern California, pump engines have a big objective . . . greatest usable horsepower at lowest operating cost. The Vapor Phase Cooling System on Caterpiller G342C Gas Engines help accomplish that objective, as verified by Diamond Bar's own careful analysis:

The parasitic load of a standard fan and pump cooling system would draw up to 10 H.P. Vapor-Phase Cooling largely depends on thermosyphon action and thus saves pump horsepower. Only a two horsepower motor is required to operate each of the electric blowers in the Vapor-Phase Cooler which converts steam to water for recirculation through the engines and also cools the lubricating oil. Vapor-Phase Cooling also avoids the possibility of water contamination that can develop in a heat exchanger installation.



Vapor Phase® Steam Separator handles both engines.

These are just two of the **many** advantages of Vapor Phase Cooling Systems that can be of profit to you in **your** installation. Learn how Vapor Phase recovers wasted heat, prevents cylinder corrosion, and maintains constant engine temperatures regardless of load. Write for complete information on this outstanding system — Vapor Phase.

Project engineered by Quinton Engineers, Los Angeles, Calif.

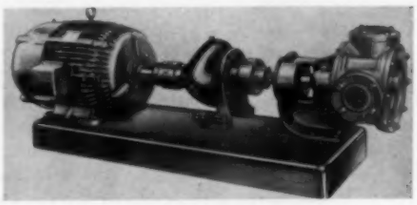
E C VAPOR PHASE

ENGINEERING CONTROLS, INC.

An affiliate of St. Louis Shipbuilding & Steel Co.

611 E. Marceau • St. Louis 11, Mo.

New Larger Capacity Pumps



Three larger capacity pumps have been added to Viking Pump Co.'s line of helical gear driven units. These include the 200, 300 and 450 gpm (nominal rating) heavy-duty, positive displacement, rotary pumps suitable for pressures up to 200 psi. A compact, independently mounted size "C" helical gear reducer accepts any one of five gear ratios capable of transmitting a maximum of 25 hp at 350 pump rpm and 40 hp at 520 pump rpm. The three size pumps with 5 gear ratios and either a 1750 or 1150 rpm motor permit a capacity range from 65 to 450 gpm. The size "C" reducer capable of transmitting up to 25 hp at 350 pump rpm has also been added to the line of smaller pumps, 50 through 150 gpm (nominal rating). This line formerly came equipped with size "B" reducers capable of transmitting up to 10 hp. This permits this series of smaller capacity pumps to be operated up to the maximum pump pressures of 200 psi. All are independently mounted gear reducers permitting all components, motor, reducer and pump, to be changed quickly. Standard couplings are used, connecting both motor and pump to reducer. For further information write Viking Pump Co., Cedar Falls, Iowa.

ITS NEW

Powermaster Test Stand

The Hartridge Powermaster test stand to be exhibited by Diesel Injection Sales & Service at the Milwaukee SAE show contains the new Hartridge variable-speed drive which gives exceptional torque at both low and high speeds, necessary when handling the large distributor type, heavier in-line, and high speed pumps. The pressurized overflow system contains no air and thus provides a most accurate means of checking cut-off and commencement of delivery. Important refinements include the Hartridge electronic and pressure phasing mechanisms which permit a saving of over 40 minutes in service time against the ordinary spill timing. Test gauges, tachometer and controls are grouped to enable the operator to control test procedure and obtain satisfactory results. The 5 hp motor gives ample power to deal adequately with a wide range of fuel pumps up to 8 cylinder capacity. Attachments and accessories are available to handle all popular base and flange mounted single, multi, and distributor type pumps manufactured by American Bosch, Robert Bosch, Bryce, C.A.V., Caterpillar, Cummins, Demco, Hartford Machine Screw, International, Lavelette, Precision-Mechanique, Scintilla-Bendix, Simms, Spica, and many others.

Bearing, Bronze Bar Exhibit

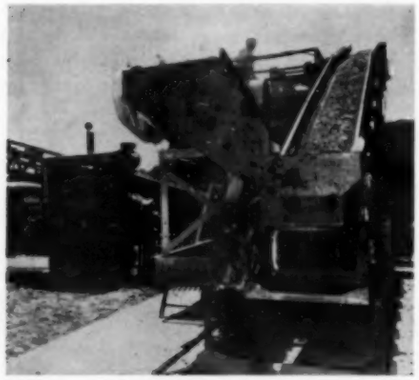
At the Milwaukee SAE Heavy Vehicles Meeting Johnson Bronze Co., will exhibit a wide range of custom made and standard sleeve bearings. Included in this product line of sleeve bearings will be bimetallic and strip—babbitt on steel or

on bronze, bronze on steel (single or double-sided), aluminum on steel, rolled bronze; powdered metals, ferrous or non ferrous; cast, bronze or aluminum. In addition the thin wall Continucast bronze bars which were only recently announced will be featured. This is a line of bars of $\frac{1}{16}$ in. and $\frac{3}{16}$ in. wall thickness and which is available through nationwide supply distributors. This new line of bar offers users savings in time and money by avoiding the need to machine excessive stock from bars.

Crushing Power Units in Display

Power units for crushing plants and similar equipment will be featured in the display of the Engine-Materials Handling Division of Allis-Chalmers at the SAE Heavy Vehicles Meeting. On exhibit will be the model 11000 open power unit with Cotta gear, sub-base and housing. The six cylinder, turbocharged, 516 cu. in. diesel develops 210 hp at 2200 rpm (bare engine rating). Also to be shown are photos of applications of the 21000 "crushing special" power units.

Allis-Chalmers 21000 crushing power unit at work for Racine (Wis.,) highway department.



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U. S. Air Force photo.

Throughout our nation's system of missile bases, diesel engines equipped with Elliott turbochargers drive the generators that produce electric power for the launching sites. By increasing the power output of the diesel engines, Elliott turbochargers permit the use of smaller engines.

For more than twenty years Elliott has been a leader in the field of turbocharging. Over 25,000 units have been built; most of the earliest are still operating. The simple rugged design and fine workmanship of Elliott turbochargers assures the dependability so vital for these missile bases as well as for all applications where reliability and low maintenance are important.

Elliott turbochargers are built in three types: Model M (left, above) for high speed engines; Model H, the high pressure design; and Model L for lower pressures. The latter two are similar in appearance (right, above). All three are simple and sturdy in construction, and precision-built. They serve the entire field of turbocharged diesel engines, 2 cycle or 4 cycle, from 160 to 6000 hp.

MI-1

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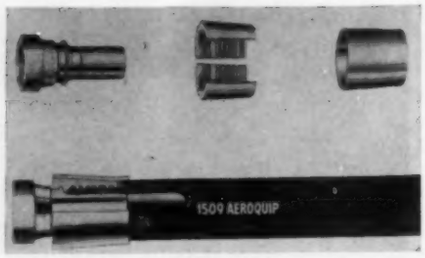
New Fitting Featured

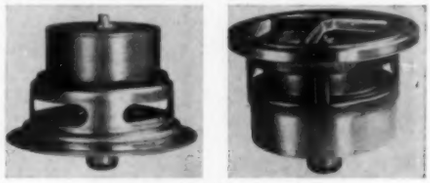
Aeroquip Corp., Jackson, Mich., will display the firm's line of Teflon hose, adaptors, special hose assemblies, sealing coupling and the Marman Divisions's clamps bands and couplings at the SAE Heavy Vehicle Meeting. Highlight of the exhibit, though, will be the Iron Mike, a new type of detachable, reusable fitting for high pressure hose assemblies, recently developed by Aeroquip. The fitting is designed for a wide range of high pressure hydraulic and pneumatic applications, as well as for fuel and lubrication systems. Iron Mike is designed for use with Aeroquip 1509 multiple wire braid hose, a high pressure type widely used in industry with other Aeroquip fittings. They are being produced in ten end fitting styles. Basically, the Iron Mike consists of three components: (1) a tapered steel socket, which is "pushed" over segments during assembly and forms a rugged compression fitting that won't blow off; (2) two aluminum segments which grip hose reinforcement securely, and mate with nipple assembly for correct positioning; (3) a steel nipple (has no threads) which fits into hose and does not cut hose inner tube. The variable component in the fitting's three-part arrangement is the nipple, which is supplied in the ten different end styles.



Iron Mike fitting consists of, from left, top, nipple, segment and socket. Lower view shows cutaway of installed fitting.

American-Standard To Introduce New Diesel Thermostats

Two new Vernatherm-operated basic waterline thermostats will be among new products featured by the American-Standard Controls Division at the SAE Heavy Vehicle Meeting. These units were developed especially to meet the increasingly rigorous requirements of water-cooled diesel engines. The first, identified as the VD-301 series, is a balanced-pressure choke-type thermostat. The other, the VD-300 series, is a bottom-controlled by-pass unit.



VD-300, left and VD-301 series Vernatherm—operated thermostats.

According to the manufacturer, both inherently offer a number of basic advantages and features. First and foremost, cooling system pressure differences have no effect on thermostat operation. As a result, opening and closing temperatures of both series remain unaffected by flow and pressure differences in the system. It is also reported the Vernatherm power element controlling the thermostat is not affected by ambient pressures.

Gould National Exhibit

The Gould National Engine Parts Division will feature products of three subsidiaries at the SAE Heavy Vehicles Meeting in Milwaukee on Sept. 11-14. The Engine Parts Division is made up of Wilkenning Mfg. Co., (Pedrick), Gillett & Eaton (G&E), and White Machine Works (Superior-Arrowhead). The exhibit will feature a working model of a ringed piston in a sleeve cutout, highlight several types of pistons with rings and cutaway sleeves. End panels will be devoted to the Pedrick piston ring story and to Superior-Arrowhead castings and sleeves made by the White Machine unit. The center section will show the product line of G&E pistons.

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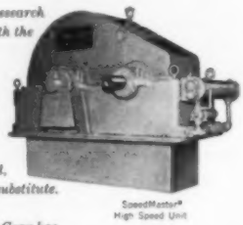

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GAS MODELS OF THREE CAT ENGINES

CATERPILLAR has added three engines to its line of natural gas engines, these latest with outputs ranging to 720 intermittent hp. In the line are the G398, a 12 cylinder Vee engine with intermittent output to 720 hp, the G379, a V8 with output to 380 hp and the G353, an in-line six rated to 380 intermittent hp. These ratings are for turbocharged and aftercooled versions of these engines which are also available in naturally aspirated models. The Cat gas engines are built of the same basic parts as the Cat diesel counterparts with only those changes necessary to make them spark ignition units. Blocks, liners, crankshafts, and other major parts are manufactured to accept the higher stresses present in the diesel versions and the structural makeup permits operation of the Cat gas versions at full power output without derating.

Here are short specifications for the three new gas units:

G398 gas engines-V12

Comp. Ratio	Inter. hp@rpm	Approx. Wt., Lb.	In. L.	Prime Power, KW	Approx. Wt. Lb.	In. L.
TA 10:1	720@1300	11,500	100	450	18,100	143
NA 10:1	530@1300	11,000	95	300	15,410	143
NA 7:1	475@1300	11,000	95	250	15,410	143

Widths are approximately 60 in. and heights are approximately 84 for TA and 68 for NA.

G379 gas engine-V8

TA 10:1	480@1300	9,200	78	300	13,610	112
NA 10:1	355@1300	8,700	72	200	13,110	112
NA 7:1	320@1300	8,700	72	150	13,110	112

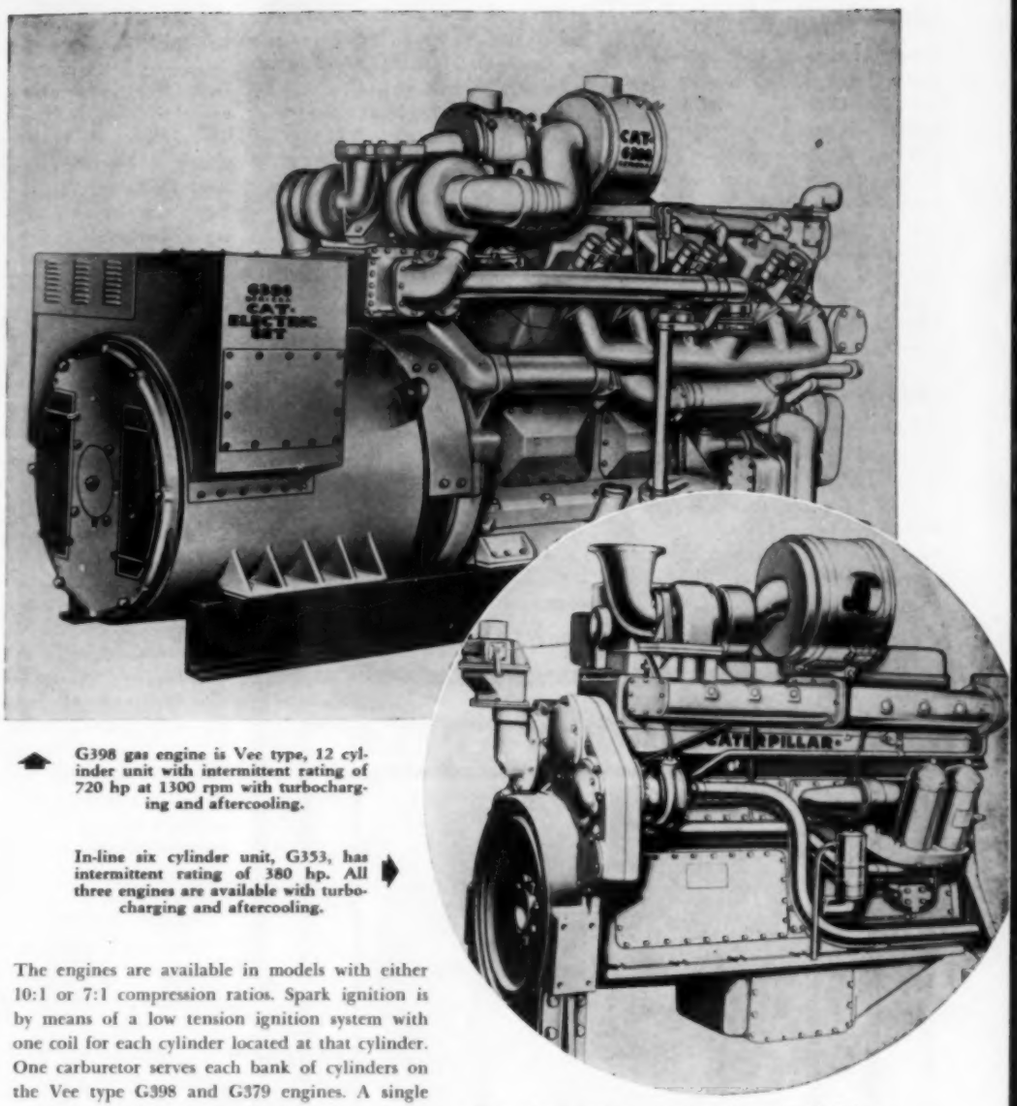
Widths are approximately 60 in. and heights are approximately 84 for TA and 68 for NA.

G353 gas engine-In Line 6

TA 10:1	380@1300	6,350	80	225	10,550	118
NA 10:1	280@1300	6,100	80	150	10,300	118
NA 7:1	250@1300	6,100	80	125	10,300	118

Widths are approximately 45 in. for the TA and 40 for the NA. Heights are 65 for TA and 67 for NA.

As can be seen from the above, these are compact engines, lending well to skid mounted and self-contained compressors, generator sets, etc., in the medium horsepower range. The 300-800 hp range is one where gas engines are finding increasing application.



G398 gas engine is Vee type, 12 cylinder unit with intermittent rating of 720 hp at 1300 rpm with turbocharging and aftercooling.

In-line six cylinder unit, G353, has intermittent rating of 380 hp. All three engines are available with turbocharging and aftercooling.

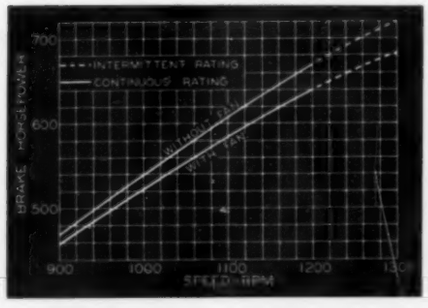
The engines are available in models with either 10:1 or 7:1 compression ratios. Spark ignition is by means of a low tension ignition system with one coil for each cylinder located at that cylinder. One carburetor serves each bank of cylinders on the Vee type G398 and G379 engines. A single carburetor is located on the left side of the G353. Regulators are located on the side of the engine. Spark plugs have double ground electrodes for positive spark over long periods.

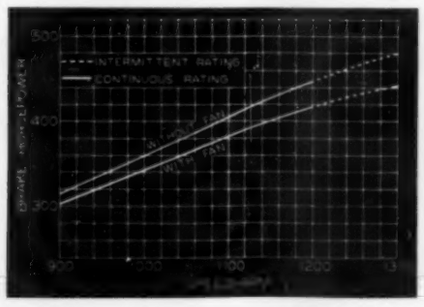
Bore and stroke on all models are the same—6½ x 8 in. The two Vee engines use twin turbochargers and a single aftercooler. A single turbocharger and aftercooler supplies air for the G353. All engines are equipped to give quick lubrication to the turbochargers when starting the engine.

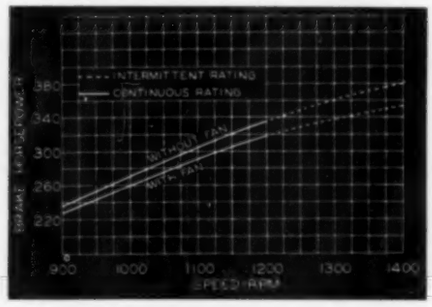
The diesel versions of the series 379 and 398 engines were described in our issue of April, 1961.

Methane type gases (commercial natural gas, sewage gas) can be burned in all three versions of the gas engines. For the high compression ratio engines, fuels should contain a maximum of 5 per cent hydrocarbons heavier than propane. The lower, 7:1, compression ratio engine can be used with a wide range of fuel gases such as butane and mixed gases.

Power curves for, left to right, Cat G398, G379 and G353 gas engines. Curves are for turbocharged and aftercooled engines with 10:1 compression ratio and 90° water to the aftercoolers. Data is approximate.







HEPCO General Manager

Robert R. Sloan has been named general manager of the Houston Engine and Pump Company. In addition to acquiring new lines of equipment for distribution, Mr. Sloan will intensify a program to increase the number of dealers throughout the South. In addition he will also carry out plans to expand the service facilities of HEPCO. Mr. Sloan was with National Supply Company where for the past four years he has served as plant engineer and staff assistant to the works manager.

Chain Line Catalog

A new catalog featuring the new horsepower ratings proposed for adoption to the American Standards Assn. by the Assn. of Roller and Silent Chain Manufacturers, has been issued by The Whitney Chain Co. Covering the entire Whitney line of power transmission chain drives, the catalog provides integrated chain and sprocket engineering and application data, all based on the new horsepower ratings proposed by the ARSCM. Copies of the catalog may be obtained from Dept. MJ, Foote Bros. Gear and Machine Corp., 4545 S. Western Blvd., Chicago 9, Ill. ITS NEW

Five Minute Oil Analysis

Shell Oil Co., has introduced an "Oilprint" Analysis system by which operators can test engine lube oils quickly in their own shop. The kit indicates whether the oil still has its anti-wear qualities, whether it has lost its ability to hold sludge in suspension and also the relative amount of soot and contaminants in the oil. It will also reveal whether there is water or anti-freeze contamination. The kit consists of a special chart on which a drop of oil to be analyzed is placed. By noting the dispersancy pattern of the drop the condition of the oil can be determined.

Carl Hayward, left, president of Continental Machinery Corporation with Bob Kafka of Anderson-O'Brien.

"THANKS TO YANMAR DIESEL ENGINES . . .

our extensive diesel line is complete," says Bob Kafka, marine sales manager for Anderson-O'Brien, Southern California General Motors distributor of marine and industrial diesels. "Many of our customers required a low horsepower diesel for auxiliary marine and industrial use. Yanmar has what we needed—a precision-built, compact, lightweight diesel engine in the 2½ to 8 BHP range. Through the facilities of Continental Machinery Corporation, U.S. distributor for Yanmar, we are assured of prompt delivery and expert technical assistance."

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Test Small Turbines For Tank Auxiliaries

Designed for operation only at –25° F. or below, three AiResearch small gas turbines are currently undergoing evaluation cold testing on new Chrysler built M-60 Army medium tanks. The turbines in use are GTCP 30 combination compressor-shaft power models, built by The Garrett Corporation's AiResearch Manufacturing Division, Phoenix, Ariz. The turbine weighs about 45 lbs. Using the turbine's inherent cold start capabilities, the units will provide the auxiliary electrical power and engine heating necessary to start M-60 engines at –65° F. This is the first known application of a small gas turbine engine to a diesel warmup system. Testing is taking place in Alaska and in the Ordnance Corps' Detroit Arsenal cold test chambers. Temporarily test mounted on the fender over the track, the turbine will drive a generator to charge the Chrysler M-60 tank's batteries and to power a main engine oil pan strip heater. In addition, warm turbine compressor bleed air will flow over the tank's air-cooled diesel engine. The turbines burn the same arctic diesel fuel as do the vehicles. AiResearch has already proposed a follow on system designed to take full advantage of the tiny turbines immediately-available 400,000 Btu exhaust heat and 30 shaft hp. This system will cut the allowable one hour of warmup and start time at extreme sub-zero temperatures to 5-10 minutes. As proposed for integral design into the M-60, the AiResearch system would: Pump hot pressurized oil through the lube system to break engines loose; flood the crankcase with hot air, and heat intake air and manifold with hot air. Driving a generator the turbines would also furnish engine cranking power, and electrically heat batteries.

Pick 6 In Service Guild

Six members of Detroit Diesel Engine Division's Service Craftsman's Guild have been named the "Top-Six" for 1960. Selections were made on the basis of grades received in written exaxminations on service procedures conducted by the factory throughout the year. One craftsman from each of Detroit Diesel's six regions was selected. The list of those qualifying and the GM Diesel distributors represented were announced February 10 by C. B. Clum, Detroit Diesel's general service manager. They are: Thomas J. Fay of South Weymouth, Mass., Hubbs Engine Co., Boston; William Poddick of Miami, Fla., Detroit Diesel Branch at Miami; Anthony N. Slaga of Bloomfield, Ohio, Ray C. Call, Inc., Steubenville; Robert L. Hughes of Mt. Carmel, Ill., Western Services, Inc., Mt. Carmel; Glen Hawkins of Houston, Tex., Stewart & Stevenson Services, Houston; and Henry W. Erickson of Seattle, Wash., Modern Motors, Inc., Seattle. GM Diesel, Ltd. of Canada also participates in the program and their "Top-Man" will be announced at a later date. The "Top-Six" with their wives will be flown to Detroit in July for plant tours, other events at the factory and a Great Lakes cruise to Mackinac Island.

New Electro-Mech Plant

Electro-Mech Corporation has moved into its new plant at 500 Livingston St., Norwood, N. J. The new facility provides greatly enlarged quarters for all departments of this industrial control system engineering firm. Paul Sutton, president of Electro-Mech, reports that all areas for designing, manufacturing and testing of control panels have been expanded, with room for further expansion built into every area. Reliance Instrument Division of Electro-Mech Corp., formerly located at Glen Cove, Long Island, has been integrated with the parent firm at this new address.

200 Point Scanner

The Bristol Co. has developed a new 200 point transistorized alarm scanner capable of scanning up to 200 measured variables at the rate of one point per second. On discovery of any "off-normal" situation, the instrument activates a recorder (which records the alarm condition measurement and reports its exact location), actuates a red alarm lamp, and energizes any desired external alarm system. Upon completion of these functions, the instrument returns to normal scanning—leaving the alarm lamp "on" until a reset button is depressed. Under normal operation, the recorder is energized only on the discovery of an alarm condition. Lamp banks on the face of the instrument allow the operator to follow the scan cycle point by point or manually adjust to single point scanning or recording. For more information write The Bristol Co., Waterbury 20, Conn. ITS NEW

Purchase 100 Tractors

Baltimore Transfer—Motor Freight Express System have purchased 100 International trucks as part of fleet expansion and replacement program. Cost of the truck purchase was $840,000. This includes 40 model BC-225-DL tractors, 25 VCO-205 tractors and 25 BC-162 and 10 BC-174 straight trucks. The 40 I-H model BC-225-DL tractors are equipped with 195-horsepower diesel engine, two-speed rear axles, dual 50-gallon aluminum step tanks and a wide range of weight saving components. Wheelbase is 143 in., and the tractors are rated at 79,000 lbs. gcw.

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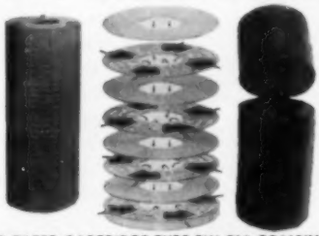

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Commercial Filters Merges With Research Firm

Merger of a Cincinnati research and development firm, RAD, Inc. with Commercial Filters Corp. of Melrose, Mass., has been recommended by directors of both firms. Announcement of the proposed merger was made by F. William Harder, chairman of the board of Commercial Filters, and Michael F. Schaible, president of RAD, Inc. It is contemplated that Mr. Schaible, who is sole stockholder of RAD, Inc., will become president and chief executive officer of the surviving company, Commercial Filters Corp. Ogden Corporation of New York is the sole stockholder of Commercial Filters, which has annual sales of approximately $10,000,000. The merger will be accomplished through an exchange of stock. Further details were not disclosed. Commercial Filters is a producer of a wide range of filters. RAD, Inc. was formed in January 1960 to carry on research and development in products and processes for industry and government. Offices and laboratory are located at 306 Lock Street, Cincinnati. Mr. Harder and Mr. Schaible said the Commercial Filters' headquarters will remain at Melrose where a plant expansion is under way. The firm also has a plant at Lebanon, Ind. and sales offices and warehouses in principal cities. RAD, Inc. will continue to operate in Cincinnati as a division of Commercial Filters. As president and chief executive officer of Commercial Filters, Mr. Schaible will succeed Robert L. Fielding, who will remain as vice-chairman of the board.

Alco Executive V.P.

W. G. Miller

William G. Miller has been elected executive vice president of Alco Products, Inc. A director of the firm since 1959, he had been vice president in charge of the company's thermal and petroleum industry equipment groups since 1960. Miller will continue his responsibility over the process equipment groups of the company, and in addition will have reporting to him the engineering, manufacturing and purchasing functions. He joined Alco as a project engineer in New York in 1932.

Bendix Application Engineer

W. R. Clow

Appointment of William R. Clow as senior application engineer for industrial Sales of the Scintilla Division, Bendix Corporation, Sidney, N.Y. has been announced. He was formerly an engineer and regional sales manager with Continental Aviation and Engineering Corp. Prior to his association with Continental, Clow was a service engineer with the Electromotive Division of the General Motors Corporation. He will promote the sales of Bendix Simms fuel injection equipment for the American market.

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Fairbanks, Morse PR Director

A. C. Moulton

A. Conant Moulton has been appointed director of public relations of Fairbanks, Morse & Co., Yonkers, N.Y. Moulton joins F-M from General Dynamics Corp., New York, where he was director, information services. Before that he was manager of the corporation's aviation public relations. He is a former city editor of the San Diego Union, and has been a correspondent for the Wall Street Journal, Time and Fairchild Publications.

Natural Gas Carburetor

A simple diaphragm operated air valve carburetor with one moving part meters air and gas in proper proportions at any throttle opening or load condition on the Impco 100 natural gas carburetor. This carburetor seals off gas flow when engine is stopped. Gas supply is taken directly from ounce regulator (such as Fisher) with no final atmospheric regulation needed. Operates at approximately 6 in. of water column pressure for 1100 Btu natural gas to 10 in.-11 in. on low Btu fuel. On liquid petroleum gas it will operate with any atmospheric regulator (such as Ensign, Century or Algas). For information write Imperial Machine Products Co. 10536 Dolores Ave., South Gate, Calif.

Prestolite Starter, Alternator

The Electric Autolite Co. will feature its new coaxial starting motor and its alternator in the Milwaukee SAE "Heavy Duty" Vehicle Meeting and Display in addition to the usual products of the company's Electrical Products Division. The new Prestolite starting motor combines the simplicity of the inertia drive appearance with the performance advantages of the "piggy-back" positive shift starting motor. Essentially, the new motor achieves its advantages by locating the shifting solenoid within the pinion housing co-axially with, and directly activating, the over-running clutch—without the need for linkage. The result is a new positive shift starting motor that offers many improvements over its "piggy-back" solenoid predecessor. After more than two years of research, Electric Autolite engineers will exhibit the new Prestolite alternator line. Prestolite alternator are available for applications where high output in the idling range is vital and where a higher priced heavy duty generator would be necessary. The line of standard alternators is now available and a heavy duty, heavy duty marine, and an extra duty aircraft type are in development. They are rugged in construction and design for a maximum operating output at all speeds, and operating characteristics exceed all dc generators of practical size.

New Prestolite alternator

Division Offers Couplings

The recently established Flexible Coupling Division of Lovell Manufacturing Co. will offer three types of a new flexing member coupling together with the Farrell-Birmingham type DE Gearflex coupling. Zane B. Laycock has been named general manager of the division which will market nationally, principally to the OEM market, through power-transmission agents. The new Lovell couplings are said to the designed around the unique flexing characteristics of a non-metallic material, trademarked Lovellex. Stocked units are available for shaft diameters from ½ in. to 3½ in. and for HP/100 rpm requirements from .3 to 29.0. The Farrel Gearflex couplings are of the double engagement gear type and are available for shaft diameters from 2 in. to 6 in. with HP per 100 rpm capacities from 19 to 512. Complete engineering data is available from Lovell Manufacturing Co., Erie, Pa. (ITS NEW)

Elliott Vice President

F. M. Fives

George Lilygren, president of Elliott Co. at Jeannette, Pa., has announced appointment of Francis M. Fives as vice president and general sales manager. Mr. Fives, a 1939 graduate of Carnegie Institute of Technology, has been associated with the industrial compressor and related machinery fields for approximately 20 years. A submarine engineering officer during World War II, he has a background of 15 years' service with Carrier Corp., Elliott's parent company, transferring from Carrier to Elliott in 1959. He came to Jeannette as manager of the compressor sales department, followed by his appointment as assistant general sales manager in late summer of 1960.

MURPHY

Why use TWO . . .
when ONE does the job better?

Years ago folks commonly used:

Accurate indicating gauges and . . .

. . . the so-called "mystery box" safety switches.

The trouble was that this method required double inventory, double installation costs, and frequently led to double trouble because there were two instruments that could go wrong.

And the way they found a safety switch was faulty was when an engine burned out.

O-27 OIL PRES. $9 user price

But Murphy *combined* the safety switch with a precision gauge and cut these former costs in half!

Now the gauge offers VISUAL PROOF the safety switch is working . . . and the safety switch PROVES the gauge is working. Simple?

SR-21 WATER TEMP. $9 user price

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MURPHY SAFETY SWITCH OF CALIFORNIA
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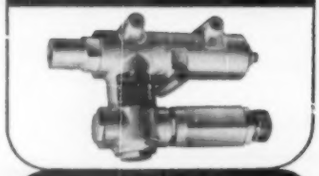
Florida Diesel News

By Ed Dennis

CAPT. Less Pearson of the 42 ft. charter fishing boat *Lesara*, repowered the craft with a pair of six cylinder 90 hp Challenger (Ford) marine diesel engines and 2:1 Paragon r&r gears. He fishes the Florida Keys.

Specify Amot controls They Give Your Engines Maximum Protection!

AMOT Model 4023 High Pressure Valve has balanced 3-way action. Suitable for pressures from 250 to 6000 psi.



AMOT Model 4021 Temperature Valve has a balanced 3-way action for pilot pressure control in any control system. Actuating temperature settings from 95 to 235° F. Available also with extensions.

AMOT Model B Thermostatic Valve has become Industry's STANDARD for Engine, Compressor, and Process temperature control. It is tamper proof. Available in 1½" to 6" in cast iron, ductile iron or bronze.

Amot controls CORPORATION
THERMOSTATIC CONTROLS
SWITCHES VALVES
SAFETY CONTROLS
413F FIRST ST. • RICHMOND, CALIF., U.S.A.

THE Miami Branch of GM's Detroit Diesel Div., G.M.C. has been equipped to handle service and parts for the Cleveland Diesel Div. in the South Fla. area. Dale Skoog is service manager.

THE 42 ft., all teak, *Sirene IV*, constructed in Hong Kong, was delivered to Bob Seman of Miami. This Krogan designed motorsailer is powered with a GM 6-71, 160 hp marine diesel engine and 2:1 r&r gears, Columbian 28x22 in. three blade propeller, for a speed of 9.4 knots.

THE *Inagua Foam* a deck cargo freighter converted from a 328 ft. navy landing craft and powered with a pair of GM 12-567 diesel engines, rated 900 hp at 744 rpm, was recently added to the fleet of West India Shipping Co. of Miami.

TWO model 65 Payhauler rear end dumps are used by the Ocala Lime Rock Corp. at Newberry to haul rock to the crusher. Power is supplied by a model NT-6-BI turbocharged four cycle Cummins diesel rated 250 hp at 2100 rpm plus a Lipe 17 in. clutch and Fuller transmission.

UP at West Palm Beach, the Marine Engine Equipment Co., installed a model 3MDSL, three kw 115 volt ac, 32 volt dc Onan dieselized generating set in the yacht *Seadream IV*, to replace a gasoline driven set.

GENERAL Engine of Tampa repowered a Michigan 125A tractor shovel for Cone Bros. with a model 3-057-C GM diesel engine and a model 15 B Bucyrus Erie dragline with a model 2030 GM for R. I. Rutledge of St. Petersburg.

MODEL HB-3 Lister Blackstone diesel engines were supplied by Shelley Tractor & Equipment to John W. Campbell of Goulds and R & J Emons, Inc. for irrigation and construction pumping. These 4x4½ in. bore and stroke diesels are rated 36 bhp.

THREE model LRI-600 Cummins diesel engines to supply power for oil drilling equipment near Zorrillos, Peru, were shipped via the *Inagua Wave* of West India Shipping Co.

A Caterpillar No. 966 Traxcavator powered with a 140 hp turbocharged Cat diesel, to Curcie Bros. of Hollywood and a No. 944 with a 105 turbocharged Cat diesel to Seminole Rock Co.

AT Nichols, the Virginia-Carolina Chemical Corp. is using a model 75A Michigan tractor shovel powered with a Waukesha 190 GL diesel (80 hp at 2200) and Clark torque converter, at its wet rock storage area.

THE 60 ft. Miami based *Emperor Gene*, skippered by Capt. John P. Pollard, has a Hercules DD-149 three cylinder four cycle dieselized Onan 15 kw generator unit on board for auxiliary power etc. Main propulsion is two GM 6-71 diesels with GM 2:1 r&r gears.

UP near Daytona Beach, the Paul Slusher Construction Co. is using four Euclid TS-24 twin power scrapers on road construction on State Road No. 44. The tractors are powered by GM 6-110 diesels rated 300 hp and the rear scraper diesel for pushing is a GM 6-71 rated 218 hp; total horsepower is 518.

THE Dell Mine, three miles west of Mayo, is using four Allis-Chalmers TC-260 motor scrapers from Richardson Tractor Co., Tampa, powered by a model 16000 Allis Chalmers four cycle diesel that develops 230 hp at 2000 rpm and Lipe Rollway clutch and Fuller transmission.

AT High Springs, Shell Products are utilizing two C6 Euclid crawler tractors in their rock quarry. The tractor is powered by a 211 hp GM 6-71 diesel engine and Allison Torqmatic drive.

POWER for the 625 kva Electric Machinery generating set operated by the Jamaica Public Service Co. at Montego Bay, is supplied by a model 660 Chicago Pneumatic six cylinder four cycle diesel rated 750 hp at 327 rpm.

AT Keystone Heights, the All Florida Sand Co. took delivery of a 12 cylinder 12V-71 General Motors 318 cont. hp diesel engine from the Jacksonville Branch of Detroit Diesel Div.

SHELLEY Tractor & Equipment supplied a model D311 Caterpillar diesel engine (50 cont hp) and Cat 2:1 r&r gears for Stayford Johnson's motorsailer.

TWO Waukesha dieselized 200 kw generating sets and four 50 kw Waukesha units, all six with Allis-Chalmers generators, for the Cape Canaveral Missile Test Center: from Simplex Sales.

MARINE Engine Equipment Co. of West Palm Beach repowered the 36 ft. motorsailer, *Fantastic*, with a model OM-636 Mercedes-Benz diesel engine and 3:1 Borg Warner hydraulic r&r gears. The engine is rated 36 hp at 3000 rpm. Edwin Mairs, N. A. built the craft.

Boat Engine Brochure

Reasons why GM diesel engines are practical for pleasure craft as small as 22 ft. are covered in a brochure just released by the Detroit Diesel Engine Division of General Motors. Performance data and basic specifications on series 53 "in-line," "inclined" and "V" diesels 97 to 195 hp are included. The brochure is titled Diesel Power Is Practical For Small Boats and it is available at GM Diesel marine engine distributors and dealers or by writing Detroit Diesel Engine Division, General Motors Corp., 13400 W. Outer Drive, Detroit 28, Mich.

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NEW AND EXCLUSIVE with McCord Model 55 Lubricator

SAFE-LEVEL SIGHT FEED

That's right! The finest lubricator on the market today has been refined to give you even *more* for your money. Now, the McCord Model 55 Lubricator comes equipped with new, exclusive Safe-Level Sight Feed with these outstanding benefits for you . . . safe, sure warning of malfunction . . . quicker priming . . . better feed regulation . . . extreme accuracy . . . improved reliability. IMPORTANT: Safe-Level Sight Feed can also be added to existing Model 55 Lubricators.

For COMPLETE details on this important new development write today to:

McCORD CORPORATION
Lubricator Division • Detroit 11, Michigan

Michigan-Ohio News

By **Jim Brown**

WOLVERINE Tractor & Equipment Co. of Detroit and Grand Rapids has sold a model T-600 Galion motor grader to C. L. C. Trucking Co. of Clarkston, Mich. The new grader is powered by a Cummins JNS-6-CI diesel engine.

MILLER Equipment Co. of Livonia, Mich. recently delivered a Michigan model 180 dozer powered by a GM 6V-53 (185 hp) diesel engine to Holloway Construction Co. of Livonia, Mich. The new 'dozer will be broken in on a highway project near Waters at Interstate 75 in Michigan.

B. L. French & Son of Pontiac, Mich. has accepted delivery on a Case model 1000 crawler tractor and front end loader. The new unit is powered by a Continental JD 382 diesel engine and was purchased from the J. R. Panelli Equipment Co. of Southfield, Mich.

R. L. Coolsaet of Dearborn, Mich. has accepted delivery on a Yaeger model 250 rotary compressor for pipeline excavation work. The new compressor is powered by a GM 3-71 diesel and was purchased from Cyril J. Burke, Inc. of Detroit.

KENT County Road Commission (Grand Rapids, Mich.) has accepted delivery on a Galion model 118 grader powered by a GM 4-71 diesel engine. Sale was made by Wolverine Tractor & Equipment Co.

LINK-Belt model 312 diesel pile hammer was recently purchased by R. E. Dailey Co. of Detroit and delivered to S. Charleston, W. Va. for work on a sewage treatment plant. Local distributor is Miller Equipment Co.

WORTHINGTON 33E dual-drum paver powered by a Cummins HBID diesel engine was recently sold to Cooke Contracting Co. of Detroit, Michigan. Sale was made by J. R. Panelli Equipment Co.

INTERLAKE Iron Corp., Toledo, Ohio recently installed a Cummins model HS-6-I engine (205 hp) with a Twin Disc torque converter in an Industrial Brownhoist Locomotive Crane. Sale was made by Cummins Diesel Michigan Inc.

HOLLOWAY Construction Co. of Livonia, Mich. has accepted delivery on three model "D" Tournapulls for work on a highway project on US 16 in Washtenaw County. The new Tournapulls are powered by GM 4-71 engines and were purchased from Telford Equipment Co. of Detroit.

CASE model W-9a front end loader powered by a Case model 301D diesel engine has been delivered to the street maintenance division of the City of Detroit. Sale was made by J. R. Panelli Equipment Co.

ALDEN White of Watervliet, Mich. has accepted delivery on an International TD-9 tractor. Sale was made by the Wolverine Tractor & Equipment Co.

EARLE Equipment Co. of Detroit has delivered a model TL-10 Tractoloader (front end loader) to Great Lakes Steel Corporation of Ecorse, Mich.

MILLER Equipment Co., reports the sale of a Michigan 380 tractor-dozer powered by a 420 hp GM 12V-71 diesel engine. The new Michgan weighs 92,000 lbs. and will be broken in by Holloway Construction Co. (Livonia, Mich.) on US 16 near Lansing, Mich.

DIGGERMAN Inc. of Wyandotte, Mich. has accepted delivery on a Case model 800 angle-dozer powered by a Continental HD-277 diesel engine. Sale was made by J. R. Panelli Equipment Co.

CUMMINS Diesel Michigan Inc. recently sold Fisher Sand and Gravel Co. of Midland Mich a Cummins NH-6-P for installation in a rock crusher.

MOLE Construction Co. of Taylor, Mich. has accepted delivery on a Case model W-3 wheel tractor-loader-backhoe combination. Distributor is J. R. Panelli Equipment Co.

DURA-BILT Homes of Kalamazoo, Mich. has accepted delivery on an International TD-9 crawler for use on their project. Sale was made by Wolverine Tractor & Equipment Co.

J. R. Panelli Equipment Co. reports sale of a Case model 1000 crawler for use in Chevrolet Gear & Axle's Monroe plant. The new Case is powered with a JD-382 diesel engine.

WOLVERINE Tractor & Equipment Co., has sold a Galion 303 grader to H. L. Workman of Jackson, Mich. The new Galion is powered by an International UD 282 diesel engine.

NANKIN Township of Wayne, Mich. has accepted delivery on a Case model W-3 wheel tractor-loader-backhoe combination with a Case B-188 diesel engine. Sale was by J. R. Panelli Equipment Co.

HOUGH H-70 Payloader powered by a Cummins JN-6-BI diesel was recently sold to Cheney Limestone Co. of Bellevue, Michigan. Sale by Wolverine Tractor & Equipment Co.

Moves New York Office

The New York branch office of The Garrett Corp., has moved from Mineola, Long Island, to 600 Old Country Road, Garden City, Long Island. This office, serving New York, Connecticut, and New Jersey, is responsible for engineering and sales for Garrett's AiResearch Manufacturing Divisions in Los Angeles and Phoenix and Garrett Manufacturing Limited, a subsidiary in Toronto, and AiResearch Industrial Division, Los Angeles.

Tachometer Catalog

A new Jones Motrola Corp. catalog is available to those having problems of speed measurement, production control, or quality control. It contains photographs and drawings and descriptions of 19 distinct types of Jones tachometers, together with drawings of various types of flexible shafts and drives and drawings of various types of flexible shafts and drives and drawings of various drive arrangements. A copy of Catalog 62 will be sent on request to Jones Motrola Corp., 432 Fairfield Avenue, Stamford, Conn. (ITS NEW)

Clark Appointment

Clark Bros. Co., has announced the appointment of James D. Gilbride as California district manager located in Los Angeles. Gilbride will also be responsible for the San Francisco branch.

AVAILABLE NOW! The completely new 1961 edition of the **DIESEL AND GAS ENGINE CATALOG,** Volume 26, can now be purchased. If you design, purchase, sell, operate or service diesel, dual fuel, or gas engines, the Catalog is essential to you and your business. This giant, 608 page, 10½ x 13½", fully illustrated reference book has been rewritten, revised and brought up to date completely from cover to cover and costs just $10 postpaid anywhere in the world. Send checks, money orders or company orders to **DIESEL AND GAS ENGINE CATALOG,** 10850 Riverside Dr., North Hollywood, Calif.

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New Power Unit

Stewart & Stevenson Services, Inc. of Houston, Tex. has announced a new forward-cab model of their self-propelled diesel engine driven 400 cycle ground power units. The new model unit, utilizing General Motors diesel engines, provides up to 140 kva, 3 phase, 400 cycle power for American built jet aircraft, as well as 112 volts dc power and 28 volt dc power for British and French jets, and American piston aircraft. This new unit will provide ground power for any commercial airliner, be it jet or piston aircraft, and like the un-cabbed self-propelled models, provides front wheel drive and steer.

The perfect trio...

. . . for the Diesel repair shop. Provides the necessary equipment for running essential tests on injection units and for re-conditioning injector nozzles.

Write for details today on utilizing this perfect trio for outfitting the smaller service shop at moderate initial cost—or on adapting the units to speed test techniques in any diesel shop.

Hartridge Electronic Fuel Pump Test Bench

For testing and calibrating all types of fuel pumps . . . provides utmost accuracy . . . rapid and easy to operate . . . combines rugged modern design.

Universal Nozzle Analyser

Meets every demand of fast, accurate nozzle testing. Permits precise observation of entire nozzle action and spray pattern. Single dial records time and pressure readings. New injector receiving clamps eliminate pipe connections.

Hartridge Nozzle Grinding & Lapping Machine

Insures perfectly concentric nozzle bodies and needles with a fine finish. Its immense scope, speed and ease of operation cut nozzle servicing costs.

Visit our display of Hartridge equipment at the SAE meeting in Milwaukee from Sept. 11 through 14.

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Telephone MAdison 2-5691

West Coast News

By James Joseph

INSTALLED aboard the motor vessel "Dixie Maid", out of Seattle, an Allis Chalmers 21000 (230 hp at 1800 rpm), sale by Pacific Marine Supply Co.

DELIVERED to Young Machinery Co., Monticello, Utah, a number of Deutz engines, including four cylinder F2L 712s (26 hp at 2300 rpm).

ESCONDIDO, Calif.'s Webb Pump and Supply Co. has taken delivery of two Lister-Blacktone HA-2 diesels (22 hp at 1800 rpm) to power irrigation pumps. Sale by San Pedro's Bolstad Sales & Service.

TO Rogers & Kuni, North Bend, Ore., for use on gravel plants and stationary units, a 150 kw, 1800 rpm Allis-Chalmers diesel electric set with Penn safety controls, directly connected to an A-C generator.

FOR new farmland development by Weston Farming Co., La Grand, Ore., eight 10000-series Allis-Chalmers diesels with 6x5, 1200 gpm pumps, the engines radiator cooled, and equipped with high water-low oil shutoffs. Sale: Hamilton Engine Sales, Inc., Portland.

REPOWERED: the halibut seiner *Susan*, owned by Einer Pedersen, Seattle, with installation of a Caterpillar D343, 300 hp continuous.

PURCHASED: by St. Francis Cabrini Hospital, Seattle, a Caterpillar D333, 125 kw diesel standby electric set. Sale: by N C Machinery Co., Seattle.

ABUILDING: special prototype diesel driven fuel pumps, under Navy contract. Pumps, for use aboard Navy vessels, are powered by American Marc WD-2s (25 hp at 1800 rpm), American's new water-cooled diesel.

FOR the 47-ft. seiner *Cindy W.*, being built by W. B. Fisheries, Bellingham, Wash., an Allis Chalmers 11000 marine diesel.

FIVE Caterpillar D330s (100 hp at 2200) will power five new Bristol Bay gillnet boats owned by Alaskan fishermen. Sale by N C Marine of Seattle.

FOR the fishing boat *Resolute*, owned by Byron Bassi, Seattle, a 300 hp Caterpillar D343, replacing boat's engine.

INSTALLED for cooling missile pad at Navy's Ordnance Test Center, China Lake, Calif., a Cummins VT8-430-IP, 430 hp at 2500 rpm engine. Engine is 8-cylinder, V-type, turbocharged. Sales by Cummins Service & Sales, Los Angeles.

REPOWERING a Crown Coach Corp. bus used by Union Carbide Nuclear Co., Bishop, Calif., to haul men from Bishop the 20 mile, 5000 ft. climb to mill at Pine Creek—a Cummins NHHT-262 (262 hp) diesel, replacing a gasoline engine.

SOLD: to Don Richcreek, for his crabbing fleet operating from the Oregon-California (Coos Bay/Crescent City) area, a 16000 Allis-Chalmers marine diesel with Capitol hydraulic gear.

KERN Rock Co. has repowered an Autocar tractor with a Cummins C160 (160 hp at 2500 rpm) engine. Sale by Cummins Service & Sales, Bakersfield, Calif.

DELIVERED: to major California oil company for powering a drill platform compressor, a Murphy MP24G dual-fuel (natural gas & diesel) engine, 182 hp at 1000 rpm.

SAN Antonio Water Co., Upland, Calif. has taken delivery of a Continental S820 (150 hp at 1760 rpm) natural gas engine for powering a deep turbine pump.

SOLD: to Emblem Homes Inc., Artesia, Calif., two U501 Continental fully automatic, natural gas engines (2070 rpm at 106 hp) powering Cascade pumps (propeller-type) for flood control. Sale by Industrial Engine Service, Los Angeles.

FOR Tommy Imanura, Gardena, Calif., a Cummins NH-220 for repowering his Peterbilt truck.

TO Piute Packing Co., Bakersfield, Calif., a Cummins JN130 (130 hp at 2500 rpm) for repowering a GMC truck. Sales by Cummins Service & Sales, Bakersfield, Calif.

Office Moved

The East Coast district sales office of the Cleveland Diesel Engine Division, General Motors Corp., has moved to 1610 Paterson Plank Rd., North Bergen, N.J. The move will consolidate the East Coast sales, service and parts activities of Cleveland Diesel in one location.

Motec Vice President

James A. Miller, director of engineering, has been appointed vice president in charge of engineering research and development of Motec Industries, Inc., Hopkins, Minn. Motec manufactures farm, automotive, construction, materials handling equipment, electronic systems, precision castings and machined products.

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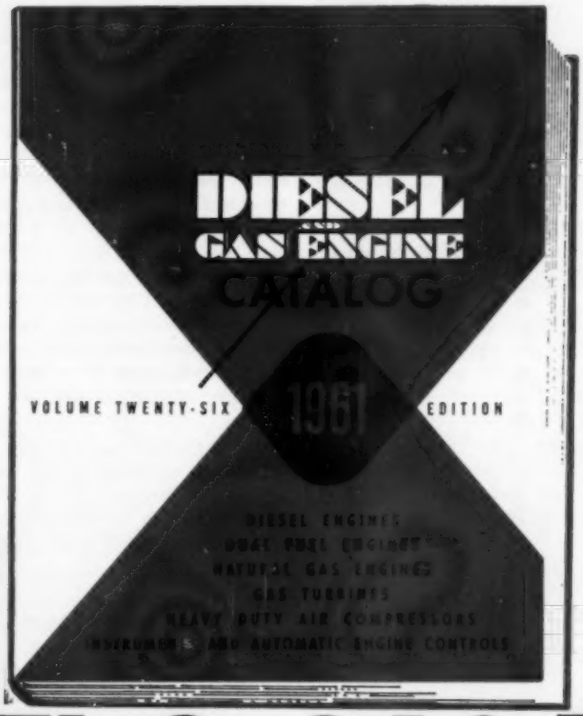
New complete information on engines and accessories!



If you design, purchase, sell, operate or service diesel, dual fuel, natural gas engines or gas turbines — **Here is important information for you!**

LOOK AT THE CONTENTS!

1. ENGINES—All major manufacturers of diesel, dual fuel, natural gas engines and gas turbines are represented in multiple page sections. Text is supplemented with specifications, power curves, photographs and sectional views.

2. TURBOCHARGERS and SUPERCHARGERS—This section of manufacturers is detailed and fully illustrated to give complete information on this increasingly important phase of the industry.

3. TRANSMISSIONS—The latest information on torque converters, fluid drives, and other modern means of transmitting power are fully described and illustrated in this section.

4. ACCESSORY EQUIPMENT—Recent developments in fuel injection systems, governors, and other key accessory units are detailed and illustrated fully in this section.

5. AIR/GAS HEAVY DUTY COMPRESSORS—This section deals with heavy duty compressors of all types applicable to all industry and petroleum services.

6. INSTRUMENTS and AUTOMATIC ENGINE CONTROL—This section covers just what the title states.

7. GAS TURBINES—This section is devoted to the gas turbines currently on the market, both in this country and abroad.

8. ADVERTISING—Leading manufacturers of engines, accessories, and services bring out the important features of their products in attractive, easy to read advertisements to further enhance the reference value of the CATALOG.

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NOW 15 to 450 GPM!

VIKING'S ENLARGED LINE OF HEAVY DUTY HELICAL GEAR DRIVEN PUMPS

Figs. 288 and 388 units with size "C" reducers, capable of handling up to 25 H.P. at 350 pump R.P.M.; 40 H.P. at 520 pump R.P.M. 20 to 450 G.P.M. capacities. Five gear ratios available, using one gear case. Six pump sizes in this series.

You now have an even larger range of Viking's helical gear driven units to fit your pumping jobs. Speed and capacity now range from 15 to 450 G.P.M. They're ideal for handling both thin and thick liquids, ranging from gasoline to molasses. Pumps equipped with packing or mechanical seals. Gear reducers independently mounted. All components can be quickly changed. Step up your delivery with these quiet, positive discharge, self-priming pumps!

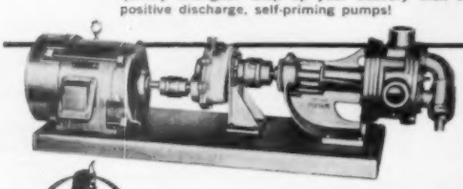

Fig. 288 units with size "B" reducers, capable of handling up to 10 H.P. at 1750 R.P.M. motor speed. 15 to 225 G.P.M. capacities. Six sets of gearing using one gear case. Six pump sizes in this series.

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Cedar Falls, Iowa, U.S.A. In Canada, It's "Roto-King" Pumps

See Our Catalog In Sweet's Industrial Construction and Plant Engineer's File

Launch Bases Featured

The current issue of *Production Road*, Twin Disc Clutch Co's quarterly magazine, contains several articles of interest. One deals with the construction of a multi-million-dollar underground launching base for the Atlas missile. Another describes a trenching machine that is able to dig a trench, line it with gravel, lay drainage tile, and replace the dirt—all in one operation. Also featured is the first on-the-job application of Twin Disc's new power-shift transmission and torque converter package. Copies may be obtained by writing to The Editor, Production Road, Twin Disc Clutch Co., Racine, Wis.

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Complete with all controls, couplings for the engine of your choice.

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1443 FIRST AVENUE, MANKATO, MINNESOTA—Phone 8-2941

Gulf Coast Diesel Notes

By Elton Sterrett

JOE Stine, Inc., Houston, has secured from Stewart & Stevenson Services, Inc., of Houston, two model 4031-C, series 71 General Motors diesels, of the closed type, which he will deliver to Sun Oil Co., of Venezuela after unitizing with other equipment.

TEXAS Highway Department, Waco, has replaced the original power on one of its road maintainers with a model 3-71 GM diesel purchased from Stewart & Stevenson Services, Inc., of Houston.

FALCON Seaboard Drilling Co., Houston, will repower one of its oilwell drilling rigs with three model D-398 Caterpillar diesels, turbocharged and aftercooled, and rated at 1050 maximum hp each. The diesels were sold by Zagst, Inc., of Houston.

MID-Continent Supply Co., Export Department, New York City, is shipping to Loffland Brothers drilling operations in Turkey three model 4031-C series 71 GM diesels furnished by Stewart & Stevenson Services, Inc., of Houston.

CARDWELL Manufacturing Co., Wichita, Kansas, has obtained from Stewart & Stevenson Services, Inc., Houston, a model 12-V series 71 GM diesel which it will use to power a well-servicing rig.

ROCKPORT Yacht & Supply Co., Rockport, Tex., is installing in a new shrimp boat a model 21000 Allis-Chalmers diesel with Twin Disc 2:1 r&r gear, furnished by Applied Power Equipment & Manufacturing Co., of Houston.

H. L. Wolfe, Brownsville, Tex., has bought from Stewart & Stevenson Services, Inc., two GM model 8V-71 marine diesel engines, rated 225 hp at 1800 rpm.

HILLMAN-Kelley, Houston, is equipping one of their specialized oil-field tools with a model 2031-C, series 71, GM diesel. The two-cylinder, closed type power unit was furnished by Stewart & Stevenson Services, Inc.

KACY Manufacturing Co., Houston, has taken delivery of four model G-149 and two model G-226 Allis-Chalmers engines from Applied Power Equipment & Manufacturing Co., Houston.

BLUDWORTH Shipyard, Inc., Houston, has secured from Stewart & Stevenson Services, Inc. A model 8V-71 General Motors marine diesel equipped with Allison 3:1 r&r gear.

JEFFERSON County Precinct Two, Port Arthur, Tex., will replace the original power unit in one of its road-making machines with a 3-71 GM diesel, supplied by Stewart & Stevenson Services, Inc.

TIDELAND Specialty Co., Houston, bought 14 model GD-157 Continental diesels from Applied Power Equipment & Manufacturing. The diesels will be used in pairs to furnish power and emergency stand-by for offshore fog horn installations on oilwell platforms in the Gulf of Mexico.

PATSO Co., Inc., Houston, has taken delivery of a series 53 GM two-cylinder diesel engine which will be unitized with the company's servicing equipment. The diesel was bought from Stewart & Stevenson Services, Inc.

LOFFLAND Brothers Drilling Co., International Operations Division, has taken delivery, through Mid-Continent Supply Company, of a Stewart & Stevenson model 25GD-20 20 Kw. D.C. generator set powered by a series 53, two-cylinder GM diesel.

BUZZINI Drilling Co., San Antonio, Tex., has purchased from Applied Power Equipment Manufacturing, a model G-138 Allis-Chalmers diesel which will be used to repower auxiliary equipment on one for the company' drilling rigs.

U. S. Army Procurement Office, Corps of Engineers, Chicago, has taken delivery of a Stewart & Stevenson 45 kw A.C. generating set powered by a 3-71 diesel. The unit is fully enclosed and skid-mounted.

Elliott District Manager

Carl F. Harms was recently appointed Minneapolis district manager for Elliott Co. Mr Harms, a graduate of the University of Illinois, joined Elliott in 1922. In 1941 he assumed the duties of manager of the then new Supercharger Department.

Sales Executives Named

Appointment of J. E. MacConville as a sales coordinator for its Special Systems division and of Fred B. Akerson to succeed him as regional industrial sales manager in Atlanta has been announced by Minneapolis-Honeywell Regulator Co. Mr. MacConville will be responsible for the sale and installation of military systems in the Southeastern United States. Mr. Akerson has been director of field education and training for Honeywell's Industrial Products Group.

Mid-West Diesel News

By L. H. Houck

BAN Truck Lease, Denver, has purchased its second P&H diesel, a model 687HE-18AT, 265 hp recently installed in a 1958 coe Kenworth tractor. Sale by Diesel Division, Harnischfeger Corp., Denver.

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PEDERSON Bros. Quarry, Harmony, Minn., has installed an Allis-Chalmers 21000 power unit on a rock crusher. Diesel from A-C dealers, Borchert-Ingersoll, Inc., St. Paul.

CAPITAL City Telephone Co., Jefferson City, Mo., a standby generator set with a Cummins V-12 diesel for its new building under construction. Sale by Cummins Kansas City.

PAIR of GM 71's, 335 hp at 2300 rpm, marine units delivered by Inland GM Diesel, Inc., to Burger Boat Co., Inc., Manitowoc, Wis., for a Burger 65 footer.

BRYAN Trucking Co., Cheyene, Wyo., a P&H diesel, model 687HE-18AT, 265 hp in a 1961 model RDF-405 International. Engine sold by Diesel Division, Harnischfeger Corp., Denver.

YELLOW Transit, Kansas City, has placed four Wolfwagons made by St. Louis Car Co. in service. Engines are Cummins LN-130, transmissions Allison MT-41, 6-step automatic, with automatic engine shutdown in case of breakaway.

N. M. Isabella, Burlington, Wis., has repowered a Koehring paver with a GM 4057C diesel from Inland GM Diesel, Inc., Milwaukee.

STEVA Stone Co., Richmond, Mo., a JN-6 Cummins diesel from Cummins Kansas City Diesel Corp., for repowering a concrete mixer truck.

STANDBY emergency electric power in the new multi-million-dollar manufacturing plant of Western Electric Co., under construction in Kansas City will be supplied from a 250 kw generator set powered with a VT-12 Cummins diesel. Rig was built in shops of Cummins Kansas City.

MURRAY Limestone Co., Garnet, Kan., a 4-cylinder Cummins diesel from Cummins Kansas City for repowering an Allis-Chalmers loader.

ALLIS-Chalmers HD16DC to John Riesterer, contractor at Concordia, Mo., from Cooke Tractor Co., branch at Sedalia, Mo.

O. W. Papen, Versailles, Mo., has taken delivery on an Allis-Chalmers HD6E from Cooke, Sedalia branch.

IDAHO County, Grangeville, Idaho, has purchased a P&H diesel engine mechanical-electrical unit. Unit has reduction gear off back of engine to power a 36 in. Kue-Ken cone crusher, and a 50 kw generator driven from front of engine which supplies electrical current to conveyors. Unit purchased through G & K Machinery Co., Boise, Idaho.

HORN'S Crane Service, Denver, has purchased a P&H 535 dragline, 1¼-yd., with 144 hp P&H diesel. Sale by Constructors Equipment Co., Denver.

GM diesel-electric generator, model 7125-7200, has been placed in service by Otto Wiesner, Inc., Superior, Wis., for powering an asphalt plant. GM 12V-71 diesel drives a Delco generator. Delivery by Inland GM Diesel, Inc., through Miller, Bradford & Risberg, Eau Claire, Wis.

ATKINSON Construction Co., Sedalia, has purchased an Allis-Chalmers HD6E with dozer from Cooke, Sedalia.

PITTSBURG Tank & Power Co., Pittsburg, Kan., a unique trailer and welding and painting rig fabricated by Cummins Kansas City. Lincoln 300 amp. welder, using a Cummins J-70 diesel for power, drives a Quincy air compressor for spray guns, which is mounted on top of welder.

BAPTIST Memorial Hospital, Kansas City, a Cummins diesel standby unit—100 kw with a HRF6 Cummins diesel.

ROY Richardson, Burlington, Wis., has Ford truck used in automobile haul out of Kenosha, Wis., repowered with a 185 hp 6V-53 GM diesel from Inland, Milwaukee.

T & O Rock & Lime Co., Sedalia. 21000 Allis-Chalmers power unit for portable crusher and TL-16-DA loader from Cooke, A-C dealers, Sedalia, Mo.

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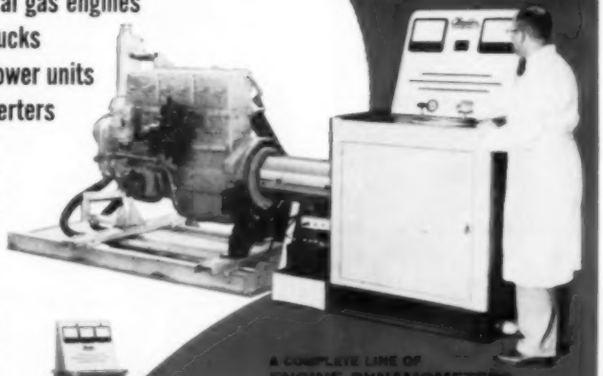

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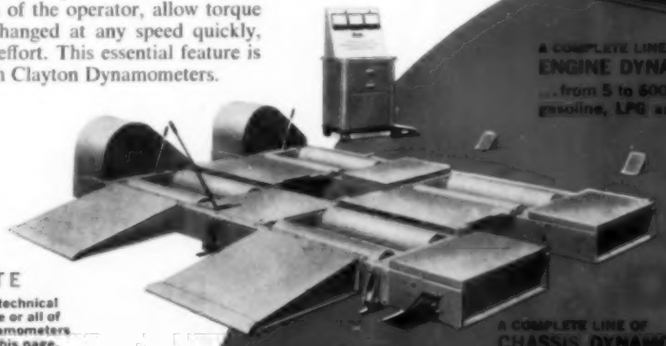

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Ray Trygg (left), Superintendent of Ogden power plant and M. P. Balcer, Operating Engineer. In background is their JS-8 turbocharged engine...one of 5 Cooper-Bessemer gas engines in the plant.

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